



FIG. 2

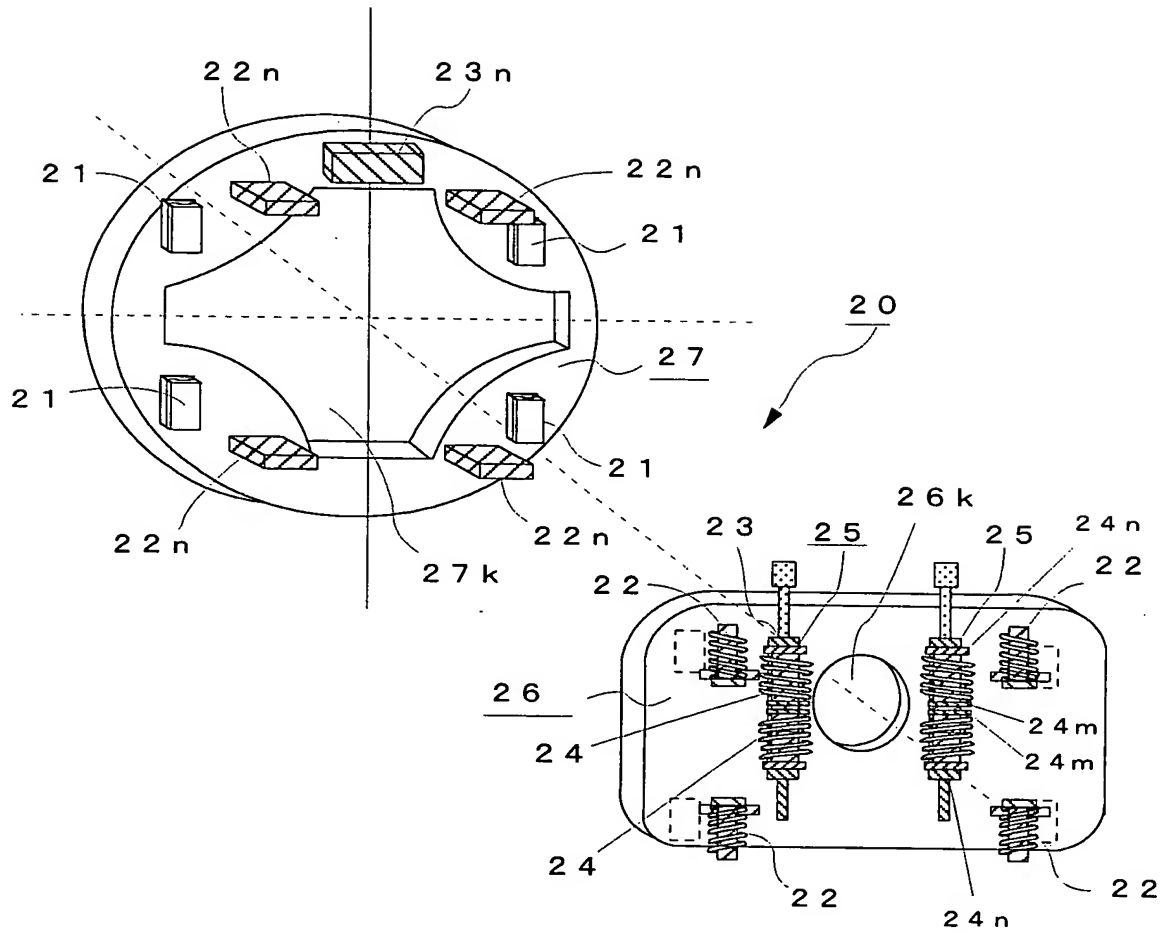


FIG. 3

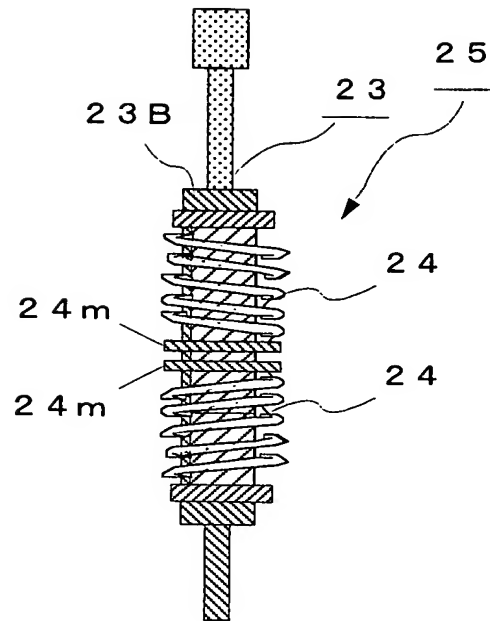


FIG. 4

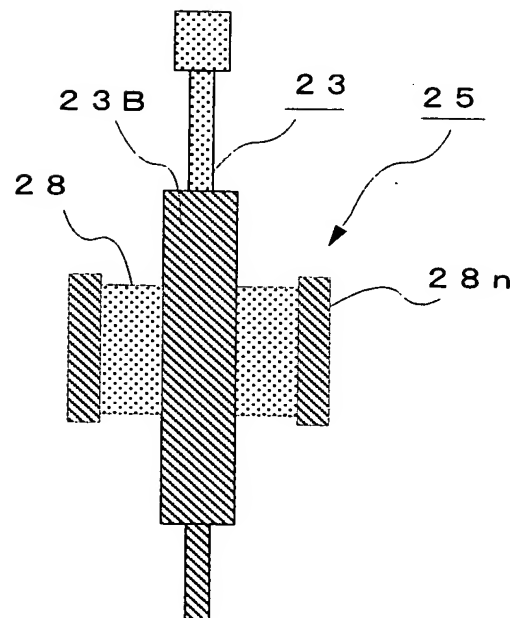


FIG. 5 (a)

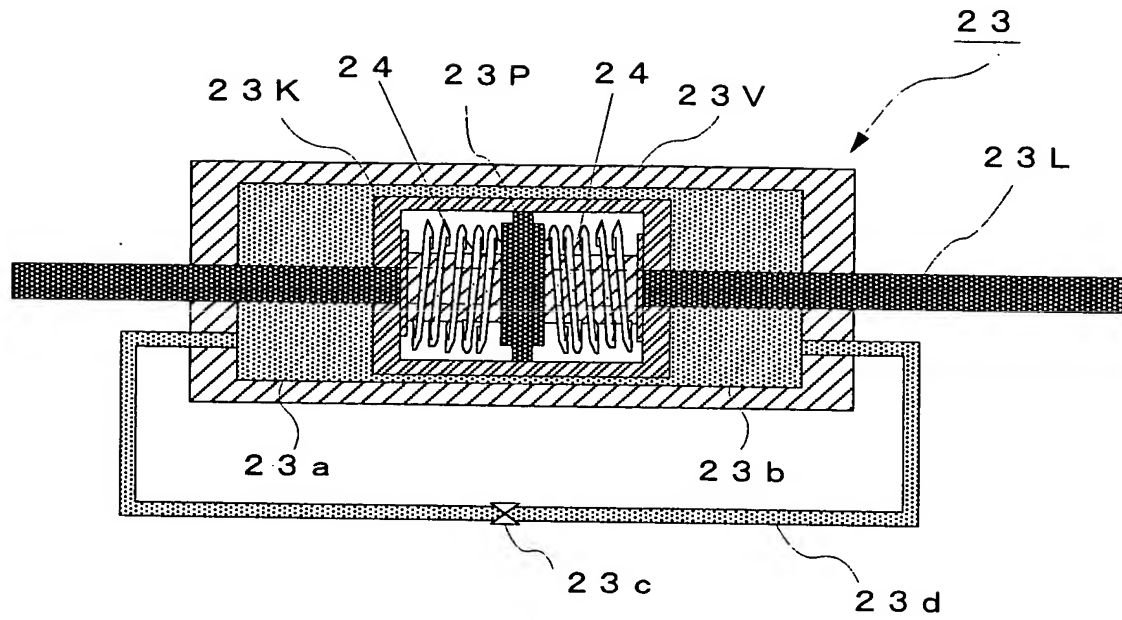


FIG. 5 (b)

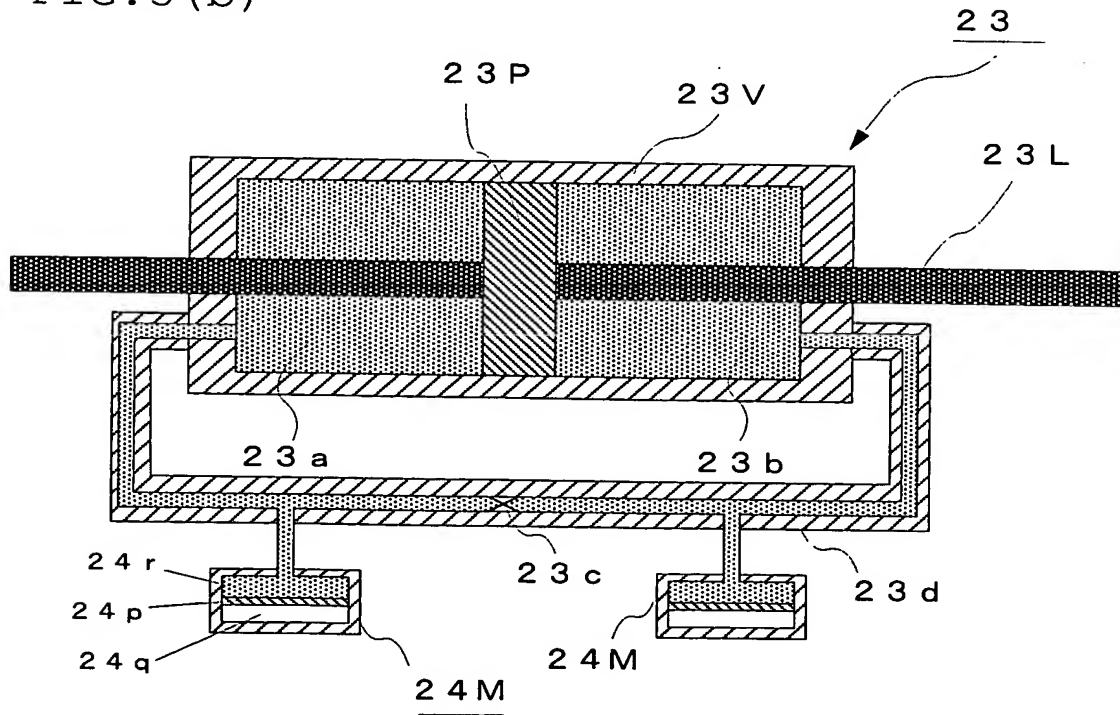


FIG. 6

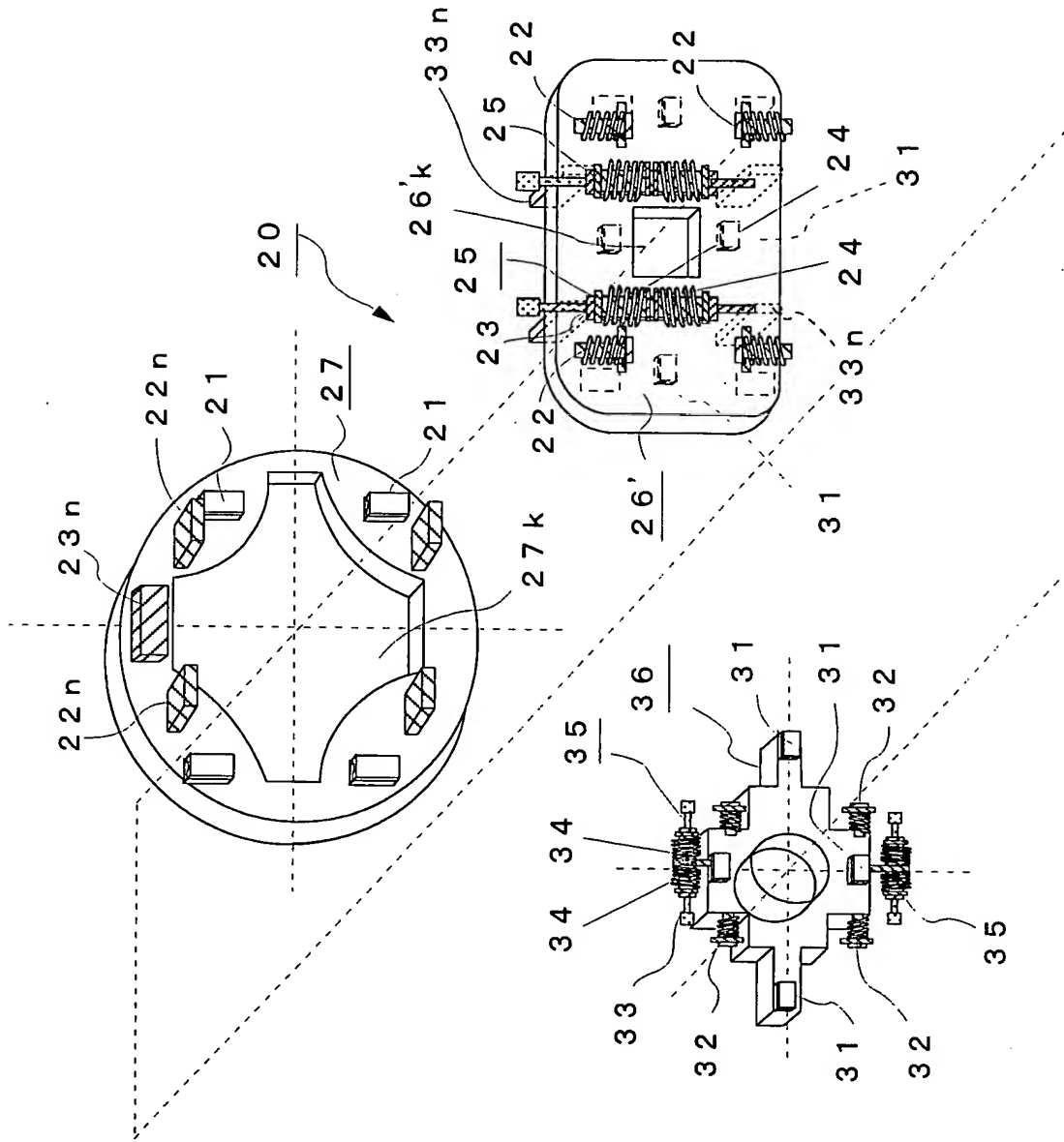


FIG. 7

|                          | COMPARATIVE<br>EXAMPLE 1 | COMPARATIVE<br>EXAMPLE 2 | COMPARATIVE<br>EXAMPLE 3 | COMPARATIVE<br>EXAMPLE 4 | EXAMPLE 1                   | EXAMPLE 2                   | EXAMPLE 3                   |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-----------------------------|-----------------------------|-----------------------------|
| TYPE                     | CAR MOUNTED              | I WM                     | DD-I WM                  | DD-I WM                  | DD-I WM<br>+ SPRING ELEMENT | DD-I WM<br>+ SPRING ELEMENT | DD-I WM<br>+ SPRING ELEMENT |
| k4 EQUIVALENT SPRING     | —                        | —                        | —                        | —                        | —                           | —                           | —                           |
| m4 EQUIVALENT MASS       | —                        | —                        | —                        | —                        | —                           | —                           | —                           |
| DYNAMIC DAMPER PORTION   |                          |                          |                          | k3 STRONG SPRING         | C3 CHANGED                  | C3 CHANGED                  | C3, k3 CHANGED              |
| MOTOR (kg)               | 30                       | 30                       | 30                       | 30                       | 30                          | 30                          | 30                          |
| FRAME DRESS-UP PART (kg) | 40                       | 40                       | 45                       | 45                       | 45                          | 40                          | 40                          |
| DAMPER MASS (kg)         | —                        | —                        | 30                       | 30                       | 30                          | 30                          | 30                          |
|                          |                          |                          |                          |                          |                             |                             |                             |
| m1 (kg)                  | 40                       | 70                       | 45                       | 45                       | 45                          | 40                          | 40                          |
| m2 (kg)                  | 370                      | 340                      | 340                      | 340                      | 340                         | 340                         | 340                         |
| m3 (kg)                  | —                        | —                        | 30                       | 30                       | 30                          | 30                          | 30                          |
| m4 (kg)                  | —                        | —                        | —                        | —                        | —                           | 5                           | 5                           |
| k1 (N/m)                 | 360000                   | 360000                   | 360000                   | 360000                   | 360000                      | 360000                      | 360000                      |
| k2 (N/m)                 | 32000                    | 32000                    | 32000                    | 32000                    | 32000                       | 32000                       | 32000                       |
| k3 (N/m)                 | —                        | —                        | 41000                    | 90000                    | 41000                       | 41000                       | 27000                       |
| k4 (N/m)                 | —                        | —                        | —                        | —                        | 110000                      | 110000                      | 110000                      |
| c1 (N/(m/s))             | 50                       | 50                       | 50                       | 50                       | 50                          | 50                          | 50                          |
| c2 (N/(m/s))             | 1500                     | 1500                     | 1500                     | 1500                     | 1500                        | 1500                        | 1500                        |
| c3 (N/(m/s))             | —                        | —                        | 1000                     | 1000                     | 600                         | 600                         | 800                         |

FIG. 8 (a) PRIOR ART

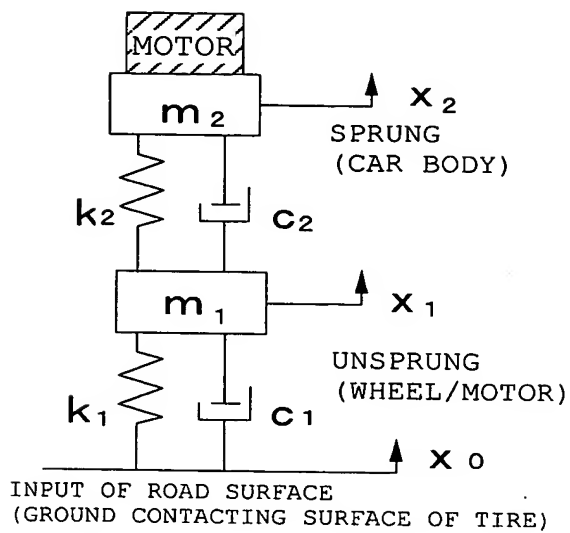


FIG. 8 (b) PRIOR ART

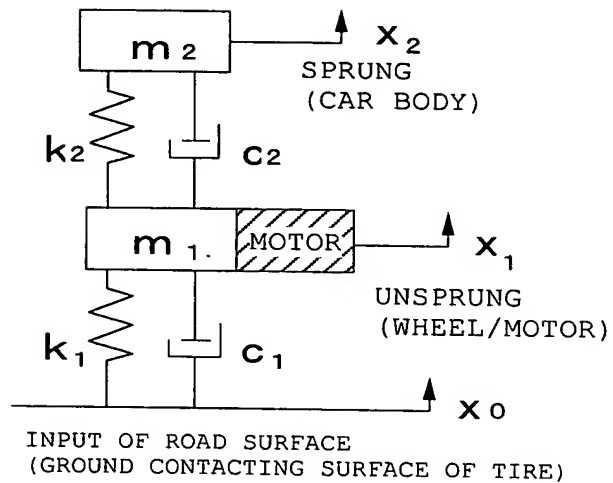


FIG. 9 PRIOR ART

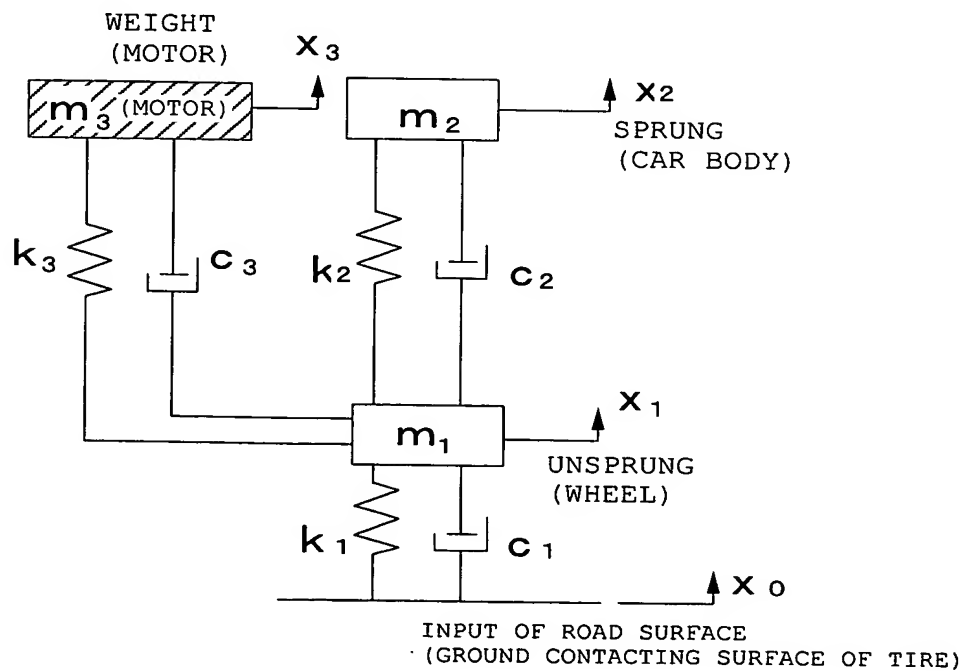


FIG. 10

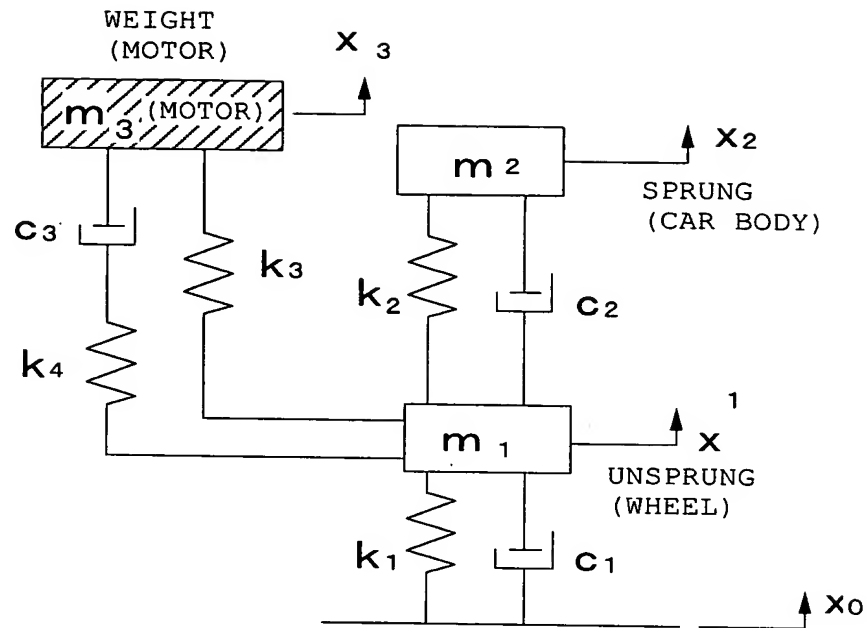


FIG. 11

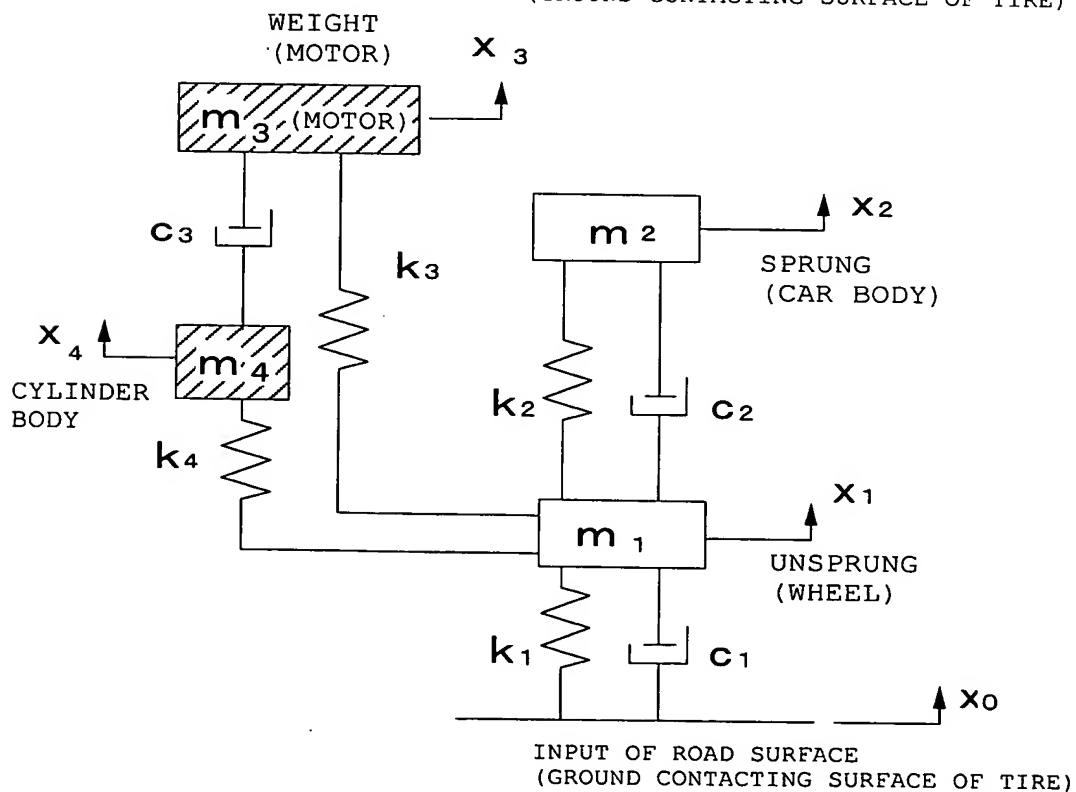




FIG.12

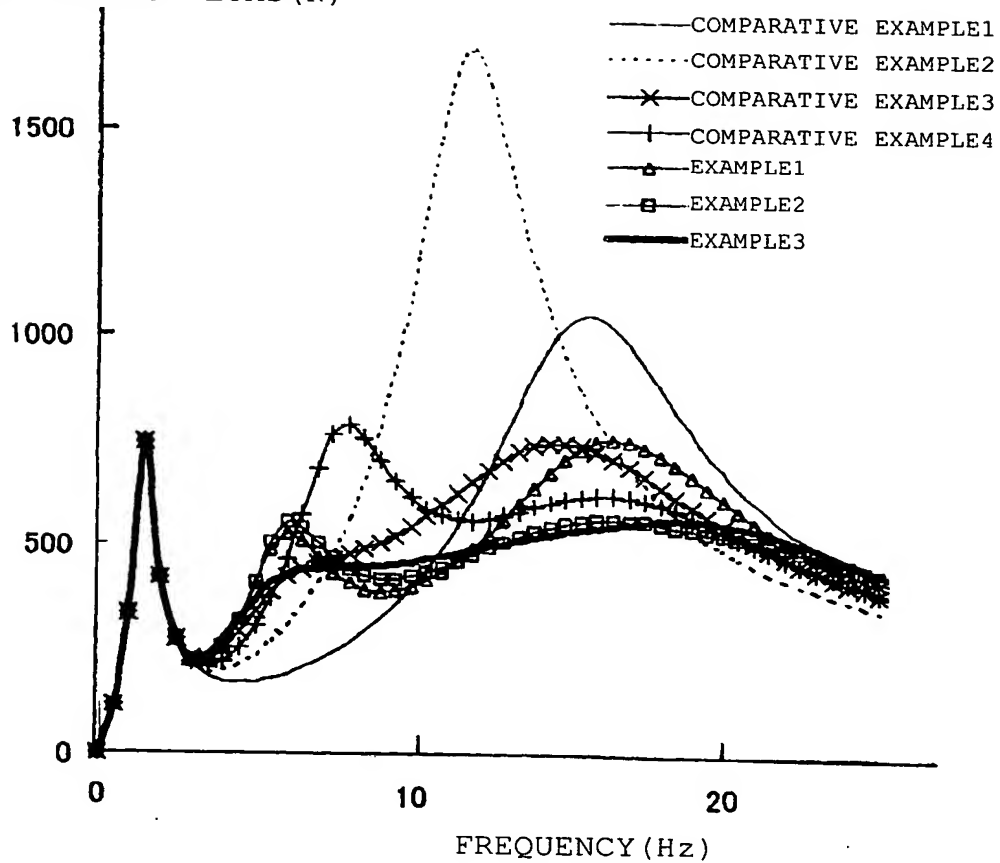
VARIATIONS IN  
GROUND-CONTACT LOAD (N)

FIG.13

| TYPE                     | COMPARATIVE<br>EXAMPLE 1 | COMPARATIVE<br>EXAMPLE 2 | COMPARATIVE<br>EXAMPLE 3 | COMPARATIVE<br>EXAMPLE 4 | EXAMPLE 1        | EXAMPLE 2            | EXAMPLE 3            |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|------------------|----------------------|----------------------|
|                          | CAR<br>MOUNTED           | IWM                      | DD-IWM                   | DD-IWM                   | DD-IWM           | DD-IWM               | DD-IWM               |
| k4 EQUIVALENT SPRING     | —                        | —                        | —                        | —                        | + SPRING ELEMENT | + SPRING ELEMENT     | + SPRING ELEMENT     |
| m4 EQUIVALENT MASS       | —                        | —                        | —                        | —                        | —                | CYLINDER ADDED TO m4 | CYLINDER ADDED TO m4 |
| DYNAMIC DAMPER PORTION   |                          |                          |                          | k3 STRONG SPRING         | C3 CHANGED       | C3 CHANGED           | C3, k3 CHANGED       |
| MOTOR (kg)               | 30                       | 30                       | 30                       | 30                       | 30               | 30                   | 30                   |
| FRAME DRESS-UP PART (kg) | 40                       | 40                       | 45                       | 45                       | 45               | 40                   | 40                   |
| DAMPER MASS (kg)         | —                        | —                        | 30                       | 30                       | 30               | 30                   | 30                   |
|                          |                          |                          |                          |                          |                  |                      |                      |
| m1 (kg)                  | 40                       | 70                       | 45                       | 45                       | 45               | 40                   | 40                   |
| m2 (kg)                  | 370                      | 340                      | 340                      | 340                      | 340              | 340                  | 340                  |
| m3 (kg)                  | —                        | —                        | 30                       | 30                       | 30               | 30                   | 30                   |
| m4 (kg)                  | —                        | —                        | —                        | —                        | —                | 5                    | 5                    |
| k1 (N/m)                 | 673000                   | 673000                   | 673000                   | 673000                   | 673000           | 673000               | 673000               |
| k2 (N/m)                 | 100000                   | 100000                   | 100000                   | 100000                   | 100000           | 100000               | 100000               |
| k3 (N/m)                 | —                        | —                        | 60000                    | 120000                   | 60000            | 60000                | 40000                |
| k4 (N/m)                 | —                        | —                        | —                        | —                        | 150000           | 150000               | 150000               |
| c1 (N/(m/s))             | 50                       | 50                       | 50                       | 50                       | 50               | 50                   | 50                   |
| c2 (N/(m/s))             | 1200                     | 1200                     | 1200                     | 1200                     | 1200             | 1200                 | 1200                 |
| c3 (N/(m/s))             | —                        | —                        | 1100                     | 1100                     | 1200             | 1200                 | 900                  |

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FIG. 14 (a) PRIOR ART

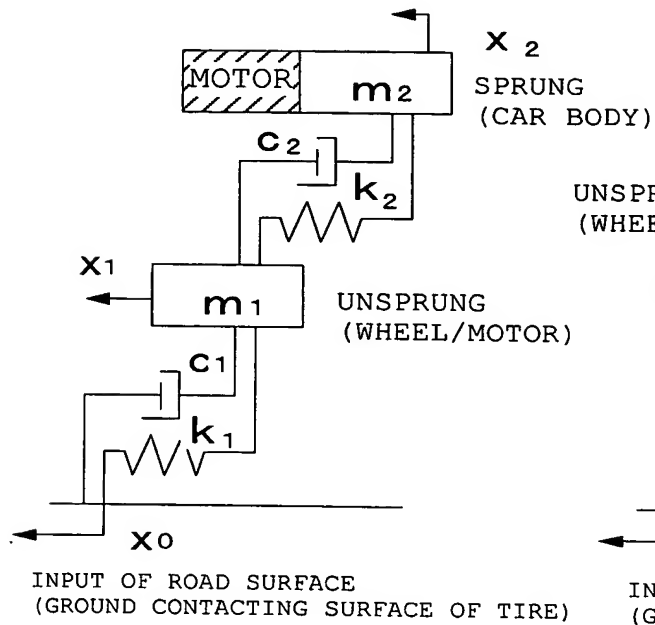


FIG. 14 (b) PRIOR ART

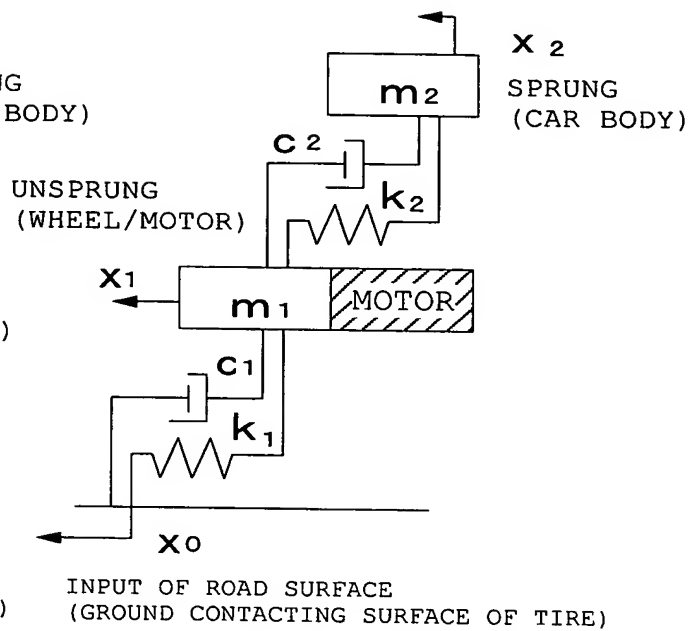


FIG. 15 PRIOR ART

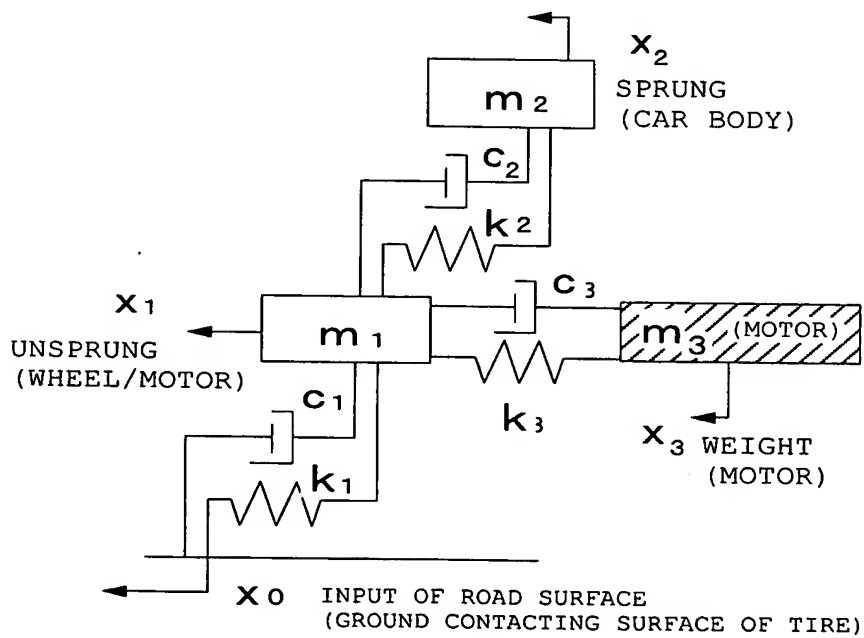


FIG. 16

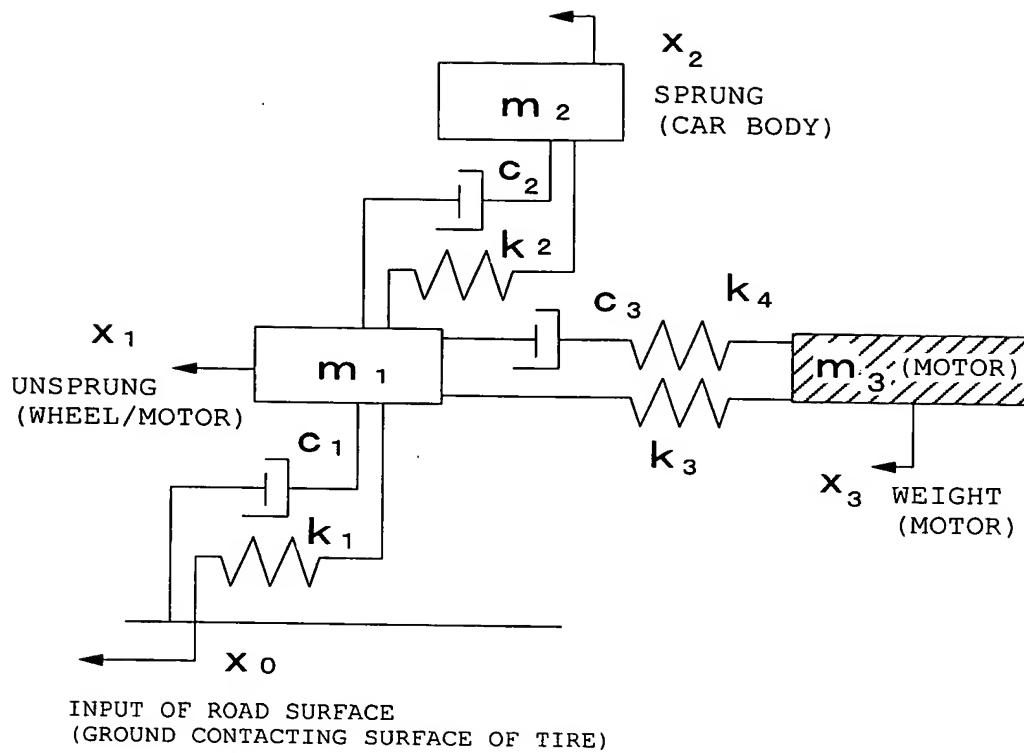


FIG. 17

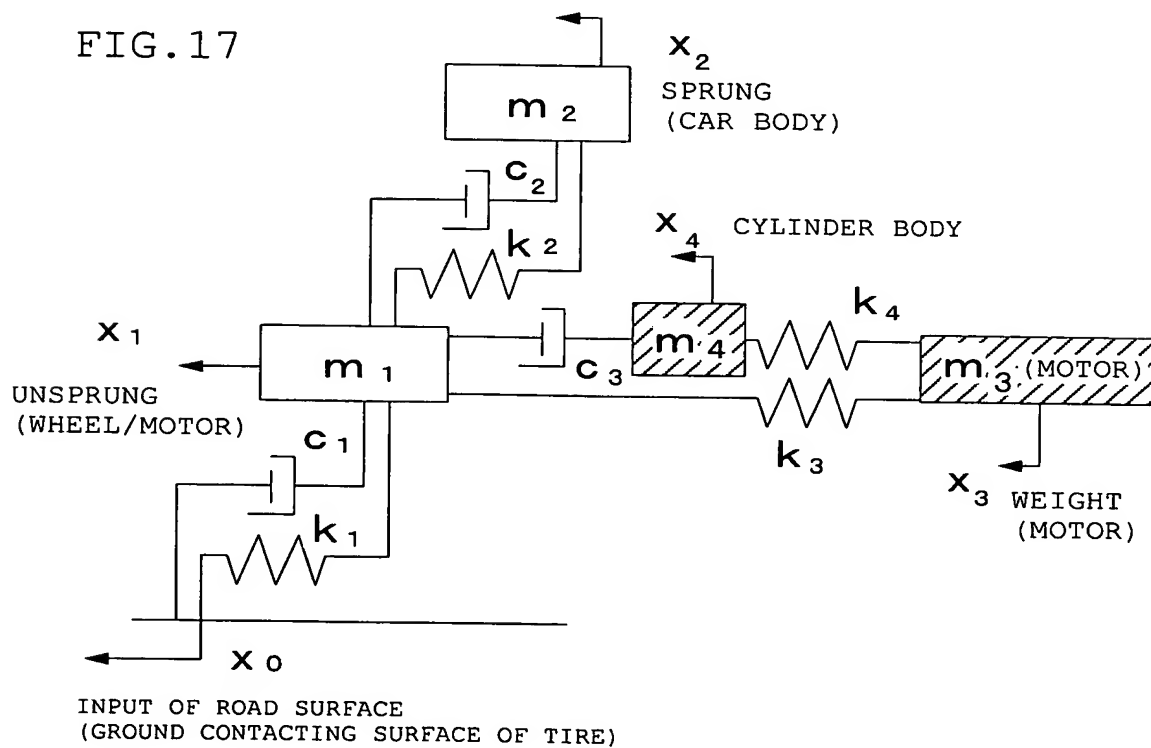


FIG.18

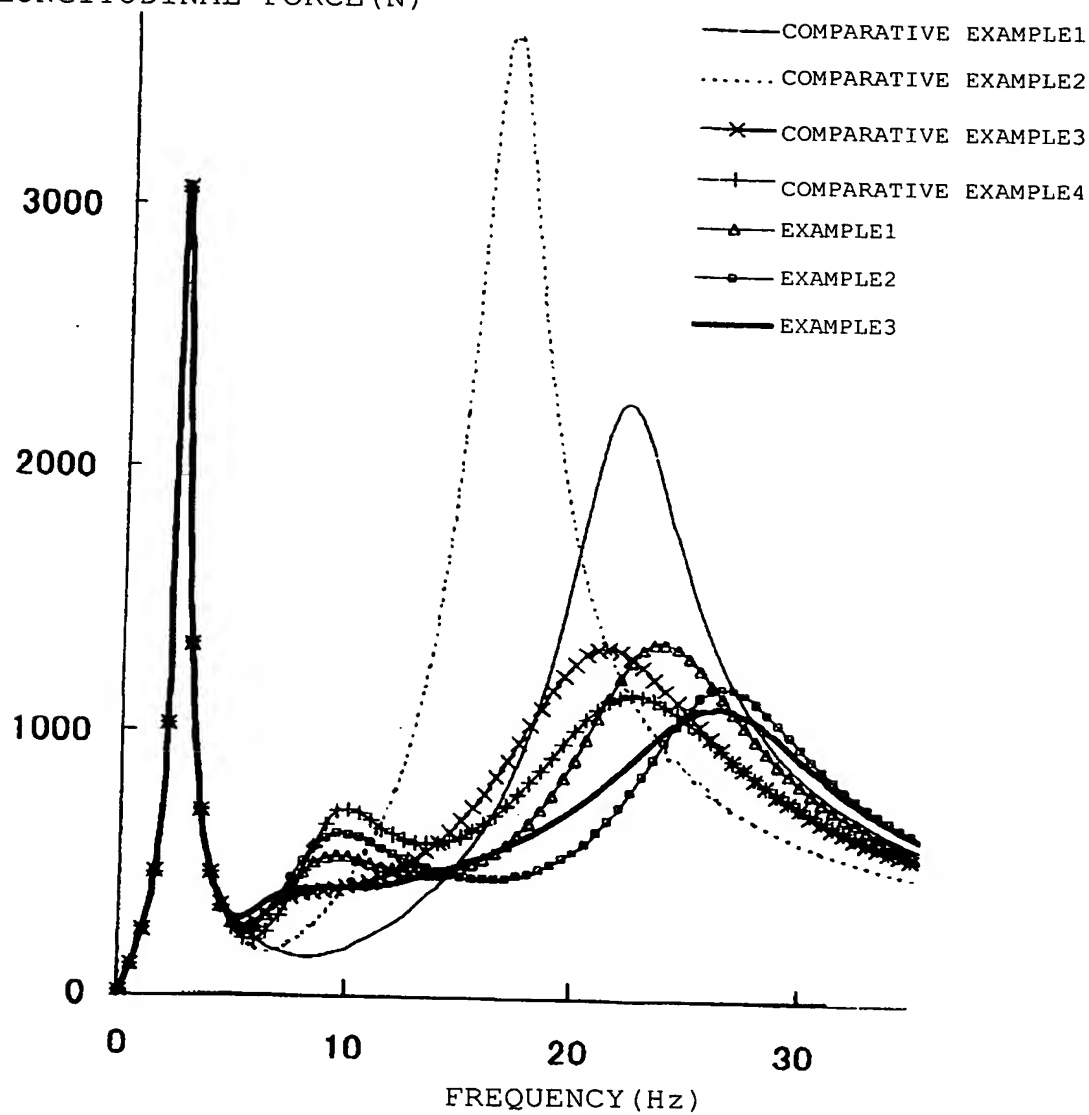
VARIATIONS IN  
LONGITUDINAL FORCE (N)

FIG. 19

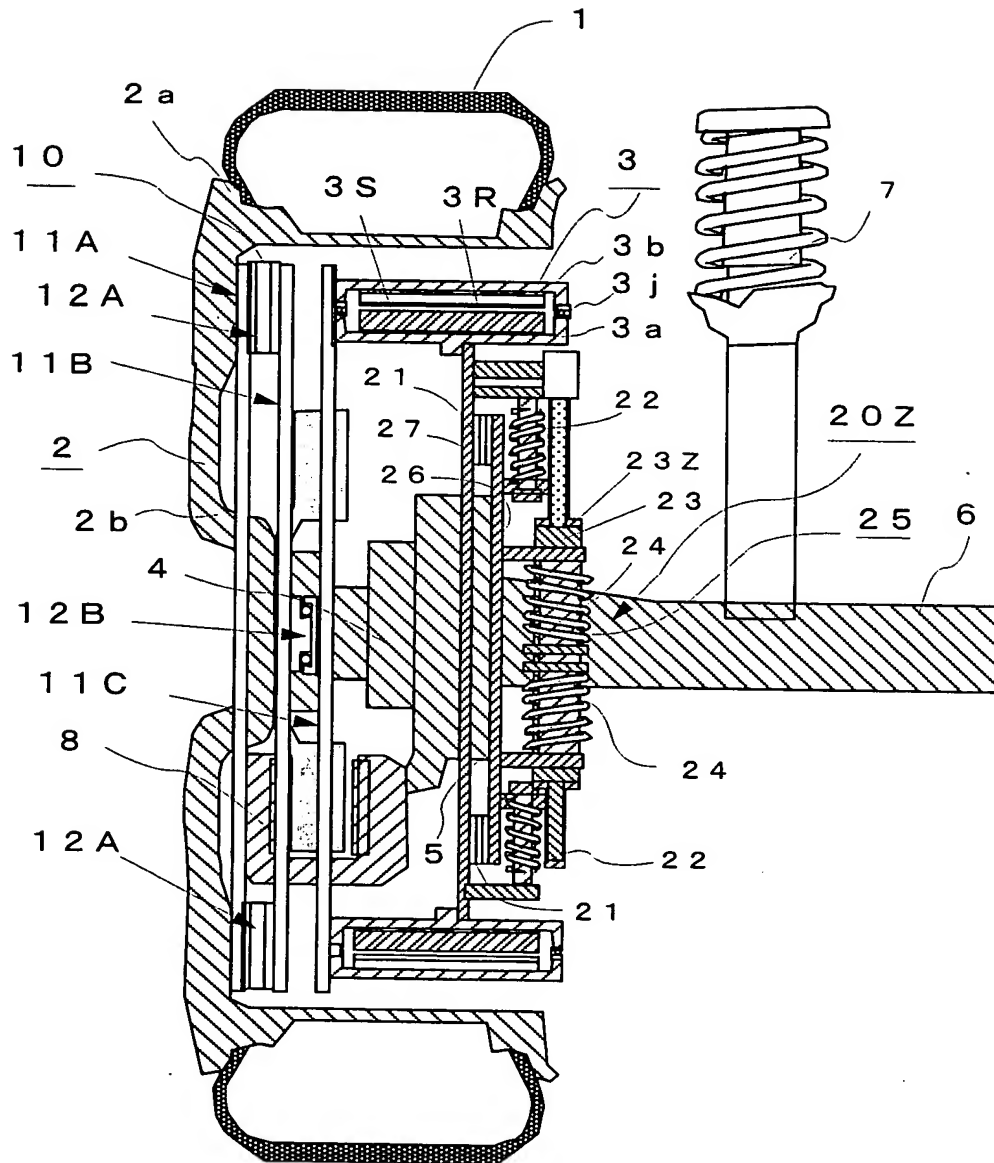


FIG. 20

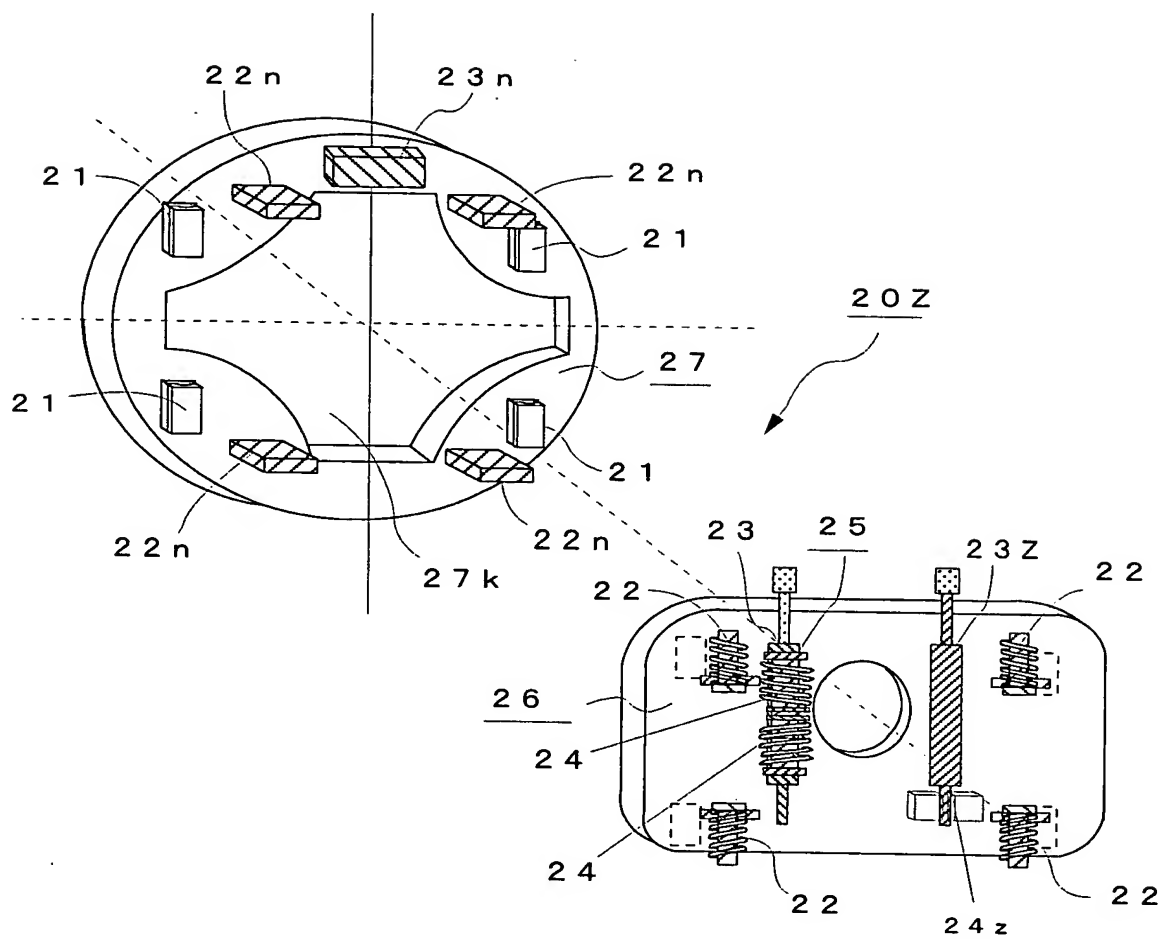


FIG. 21

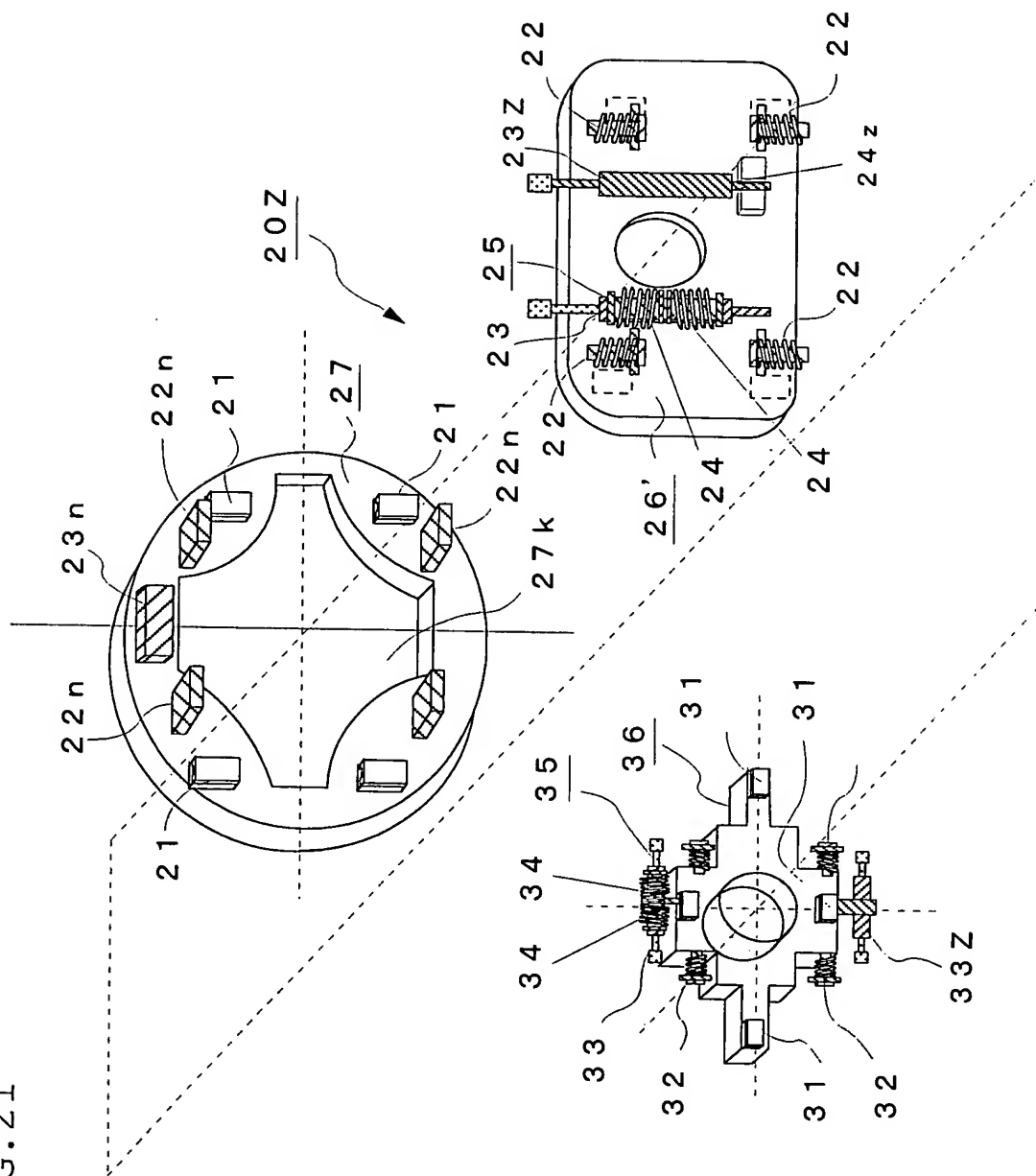




FIG.22

|  | COMPARATIVE<br>EXAMPLE 1 | COMPARATIVE<br>EXAMPLE 2 | COMPARATIVE<br>EXAMPLE 3 | EXAMPLE 1      | EXAMPLE 2 |
|--|--------------------------|--------------------------|--------------------------|----------------|-----------|
| m3 MASS (MOTOR MASS)                     | —                        | —                        | MOTOR                    | MOTOR+CYLINDER | MOTOR     |
| c3 EQUIVALENT DAMPING                    | —                        | —                        | —                        | STRONG         | WEAK      |
| c4 EQUIVALENT DAMPING                    | —                        | —                        | —                        | WEAK           | STRONG    |
| k4 EQUIVALENT SPRING                     | —                        | —                        | —                        | STRONG         | WEAK      |
| m4 EQUIVALENT MASS                       | —                        | —                        | —                        | —              | CYLINDER  |
|  |                          |                          |                          |                |           |
| UNSPRUNG MASS m1 (kg)                    | 40                       | 70                       | 45                       | 40             | 40        |
| SPRUNG MASS m1 (kg)                      | 370                      | 340                      | 340                      | 340            | 340       |
| MASS m3 (kg) OF DYNAMIC DAMPER (MOTOR)   | —                        | —                        | 30                       | 35             | 30        |
| CYLINDER MASS m4 (kg)                    | —                        | —                        | —                        | —              | 5         |
| TIRE LONGITUDINAL SPRING k1 (N/m)        | 360000                   | 360000                   | 360000                   | 360000         | 360000    |
| CAR SUSPENSION SPRING k2 (N/m)           | 32000                    | 32000                    | 32000                    | 32000          | 32000     |
| MOTOR SUPPORTING SPRING k3 (N/m)         | —                        | —                        | 41000                    | 41000          | 30000     |
| DAMPER SUPPORTING SPRING k4 (N/m)        | —                        | —                        | —                        | 170000         | 120000    |
| TIRE DAMPING c1 (N/(m/s))                | 50                       | 50                       | 50                       | 50             | 50        |
| SUSPENSION DAMPING c2 (N/(m/s))          | 1500                     | 1500                     | 1500                     | 1500           | 1500      |
| DAMPER ① c3 (N/(m/s)) FOR DYNAMIC DAMPER | —                        | —                        | 1000                     | 1000           | 200       |
| DAMPER ② c4 (N/(m/s)) FOR DYNAMIC DAMPER | —                        | —                        | —                        | 500            | 900       |

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FIG. 23 (a) PRIOR ART

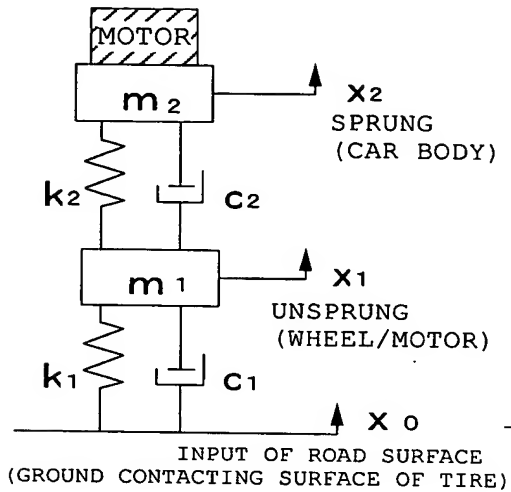


FIG. 23 (b) PRIOR ART

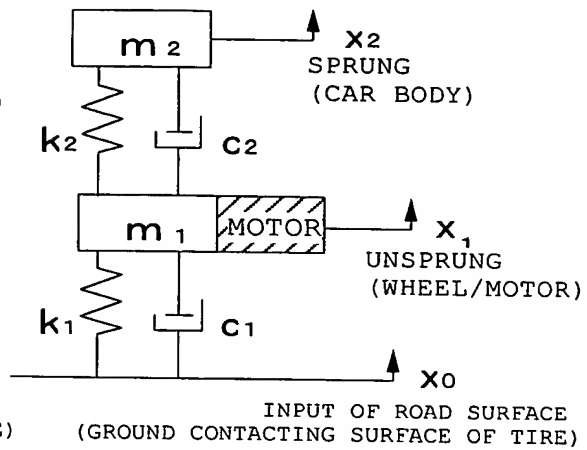


FIG. 24 PRIOR ART

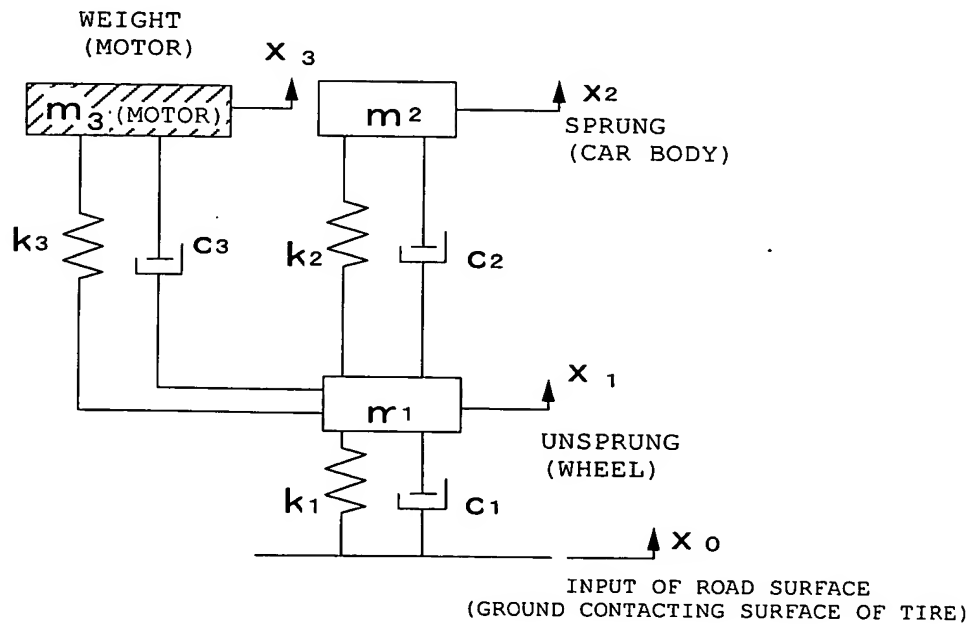


FIG. 25

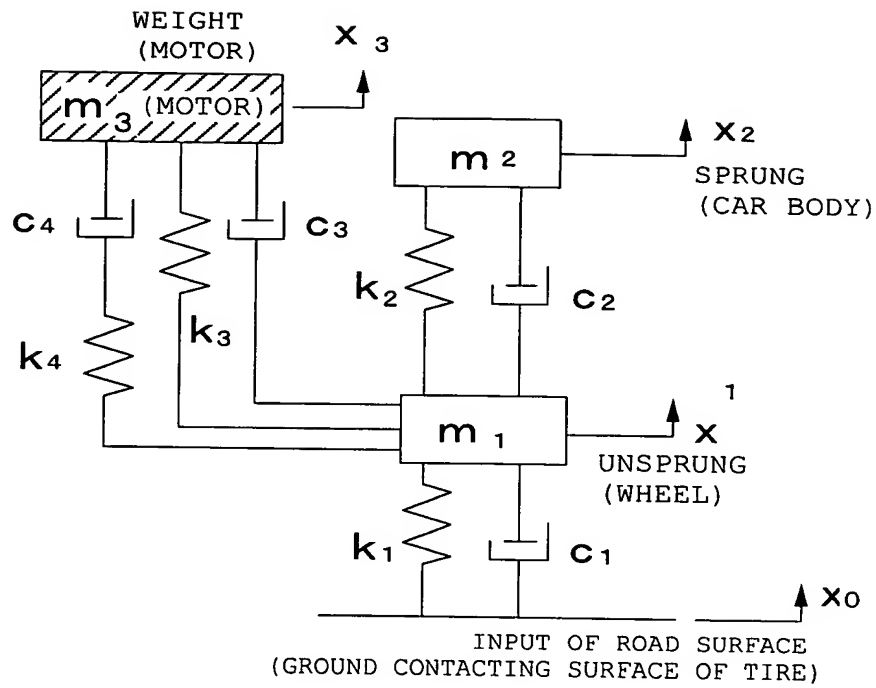


FIG. 26

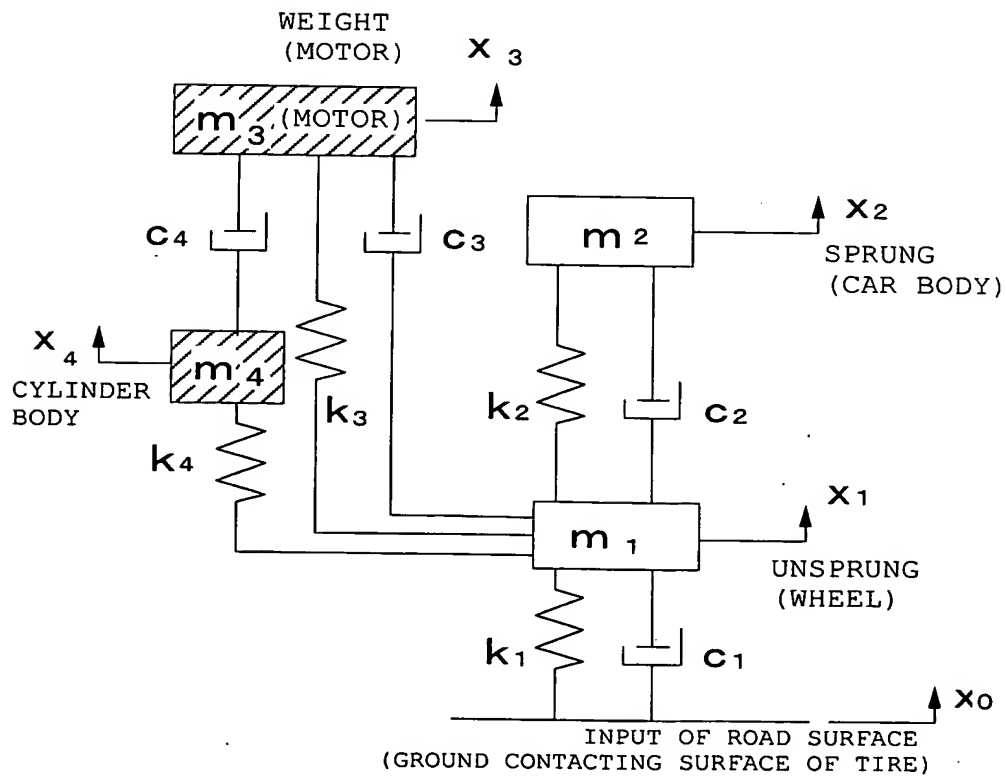


FIG. 27

VARIATIONS IN  
GROUND-CONTACT LOAD  
OF TIRE (N)

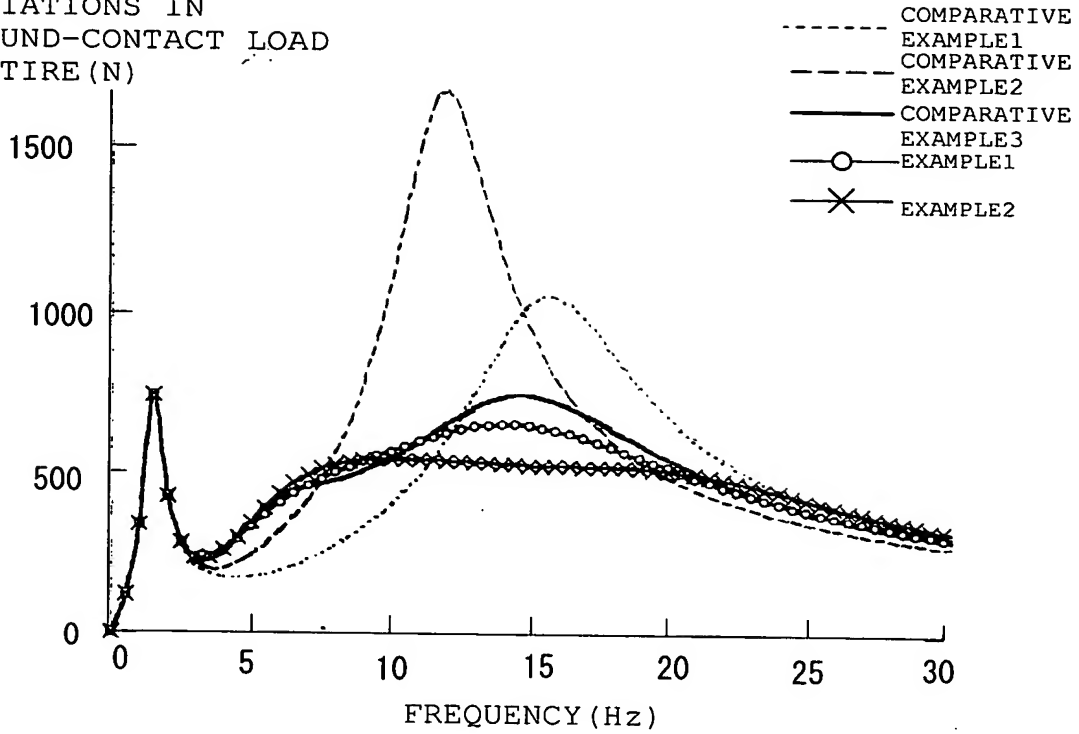


FIG. 28 (a) PRIOR ART

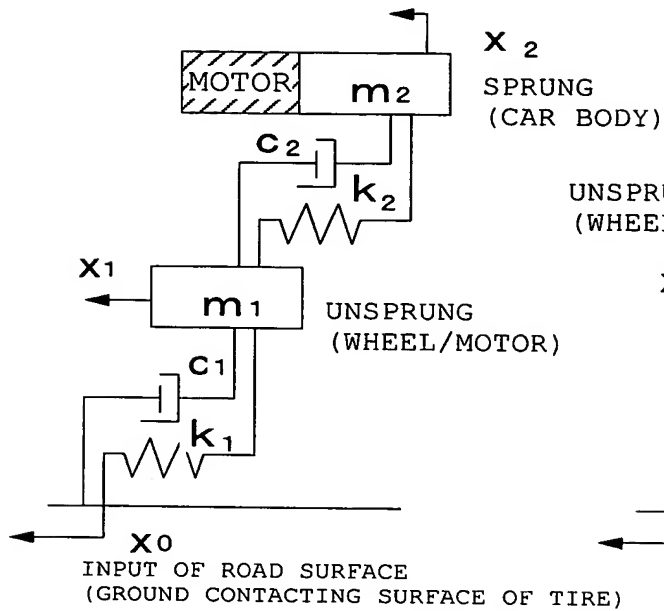


FIG. 28 (b) PRIOR ART

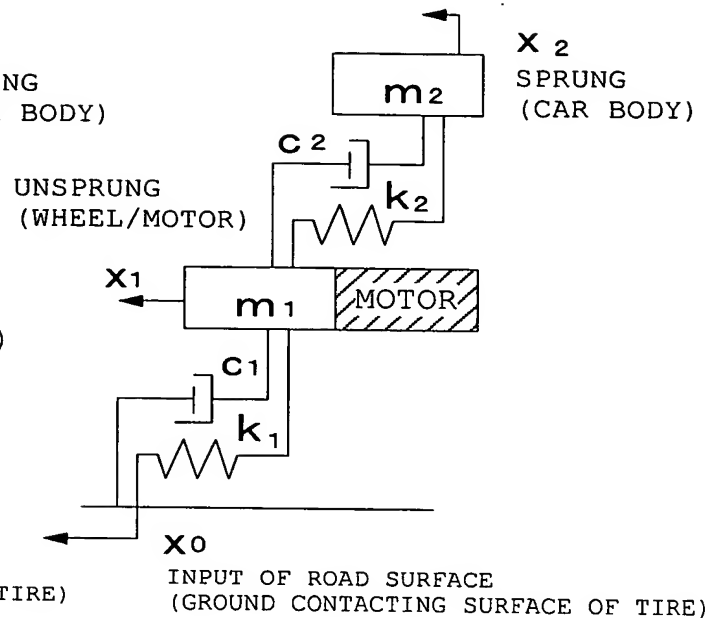


FIG. 29

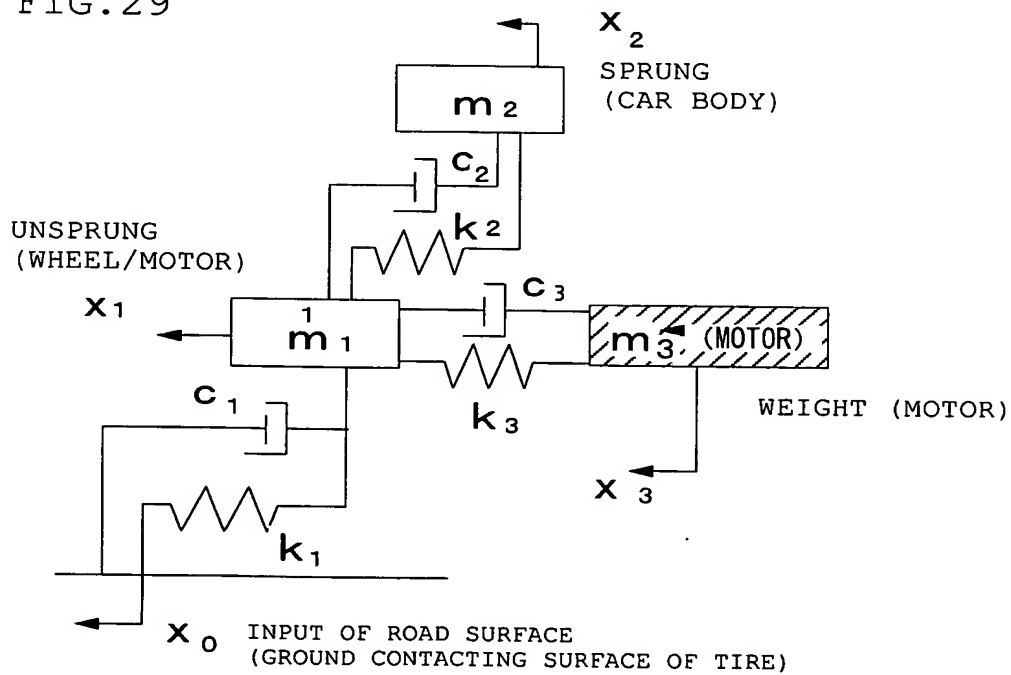


FIG. 30

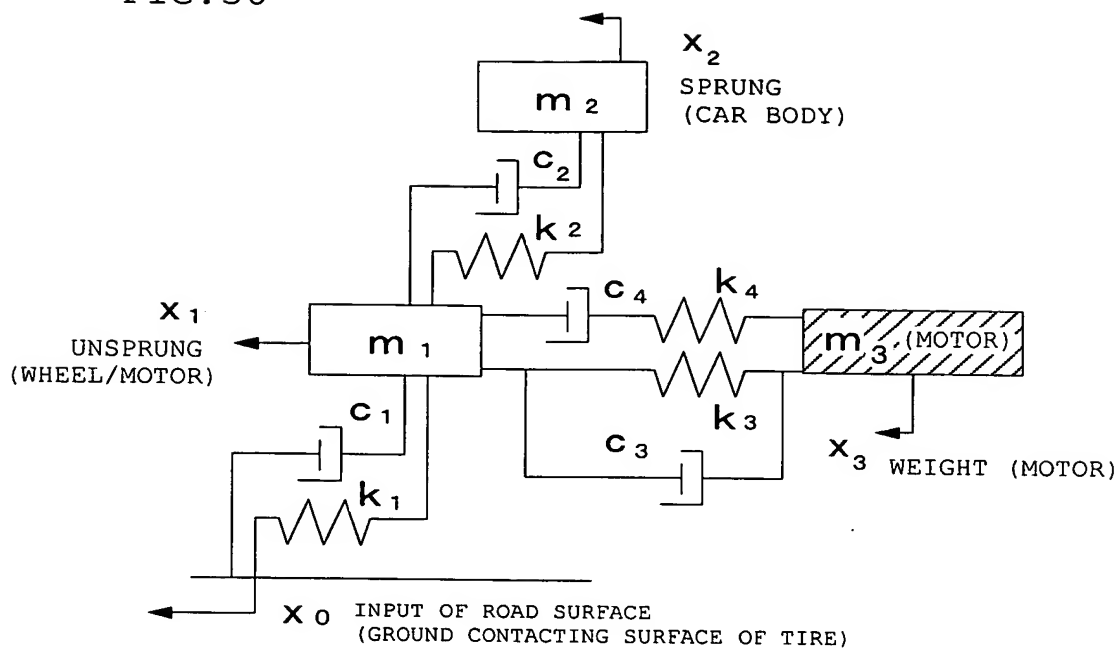


FIG. 31

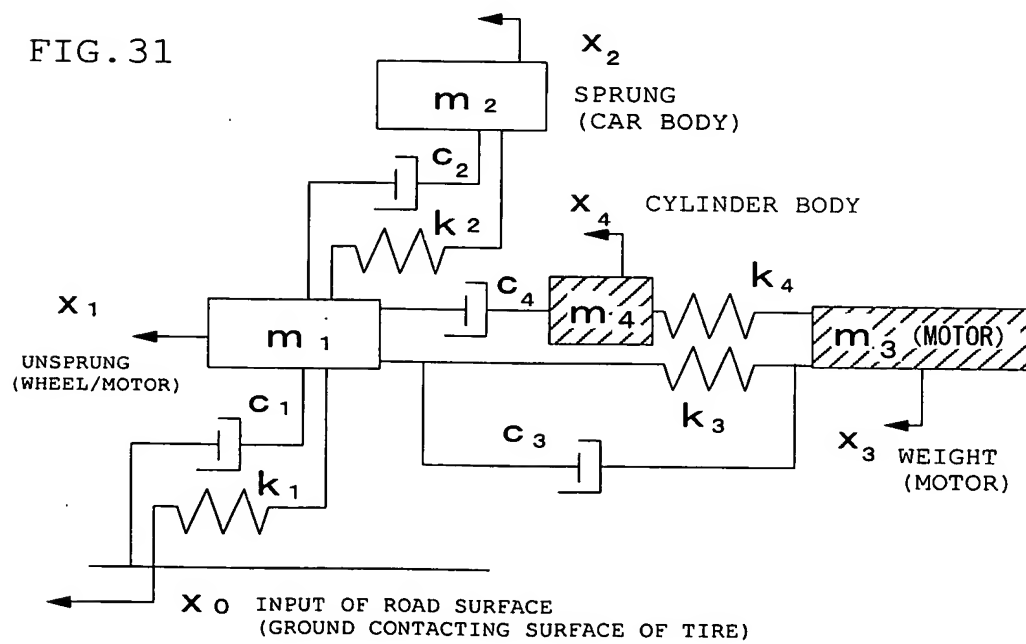


FIG. 32

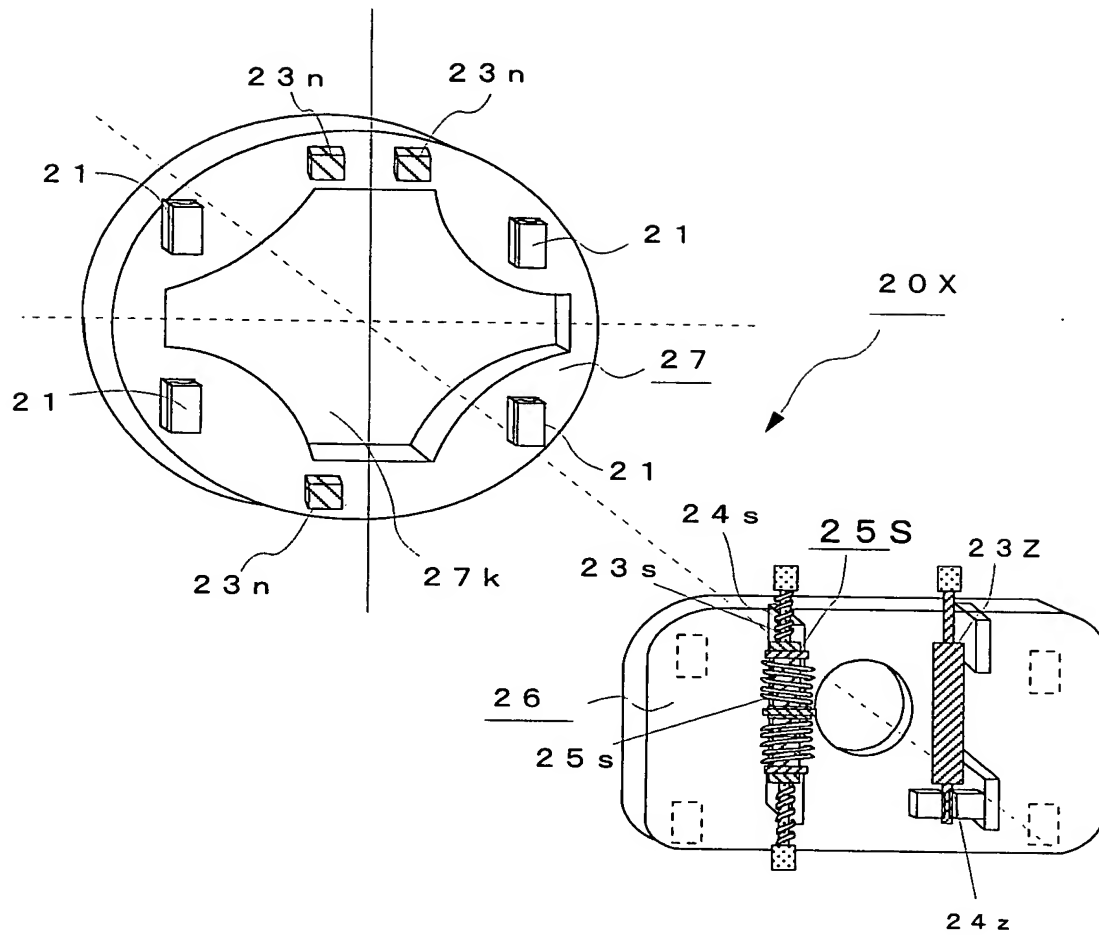


FIG. 33

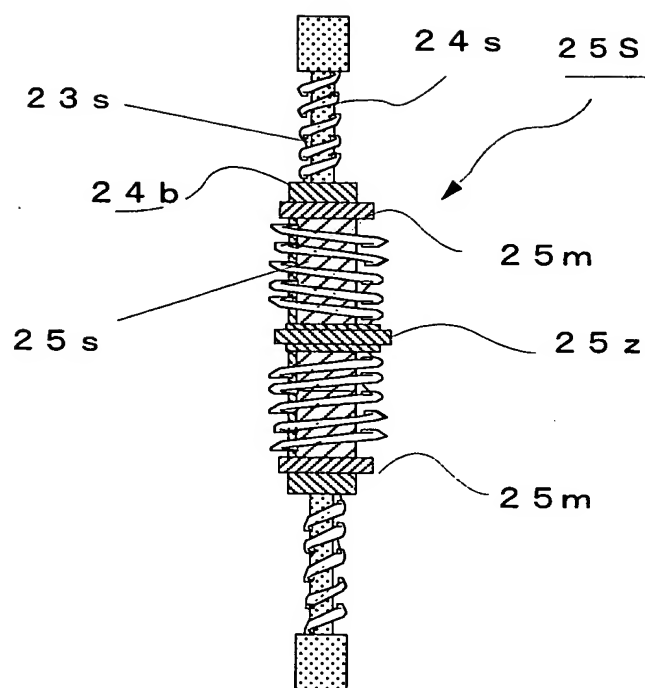




FIG. 34

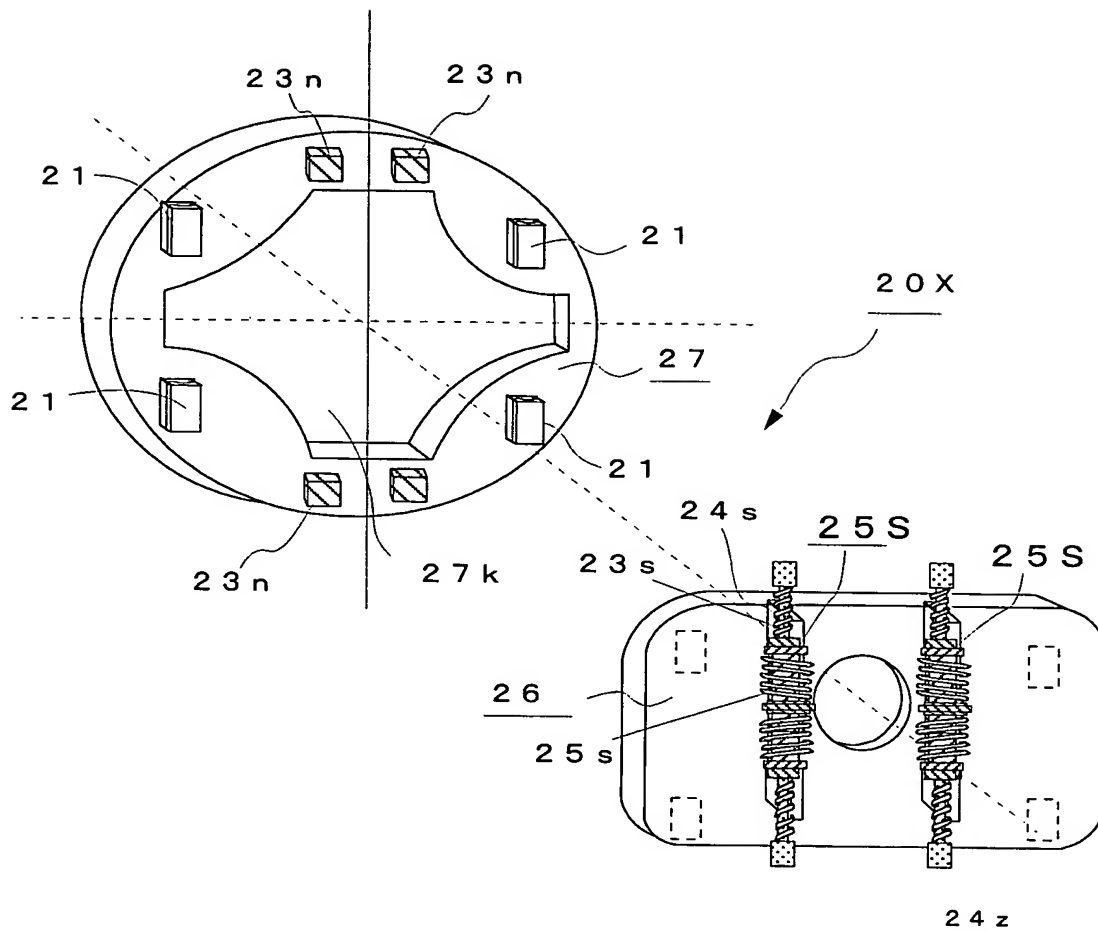


FIG. 35

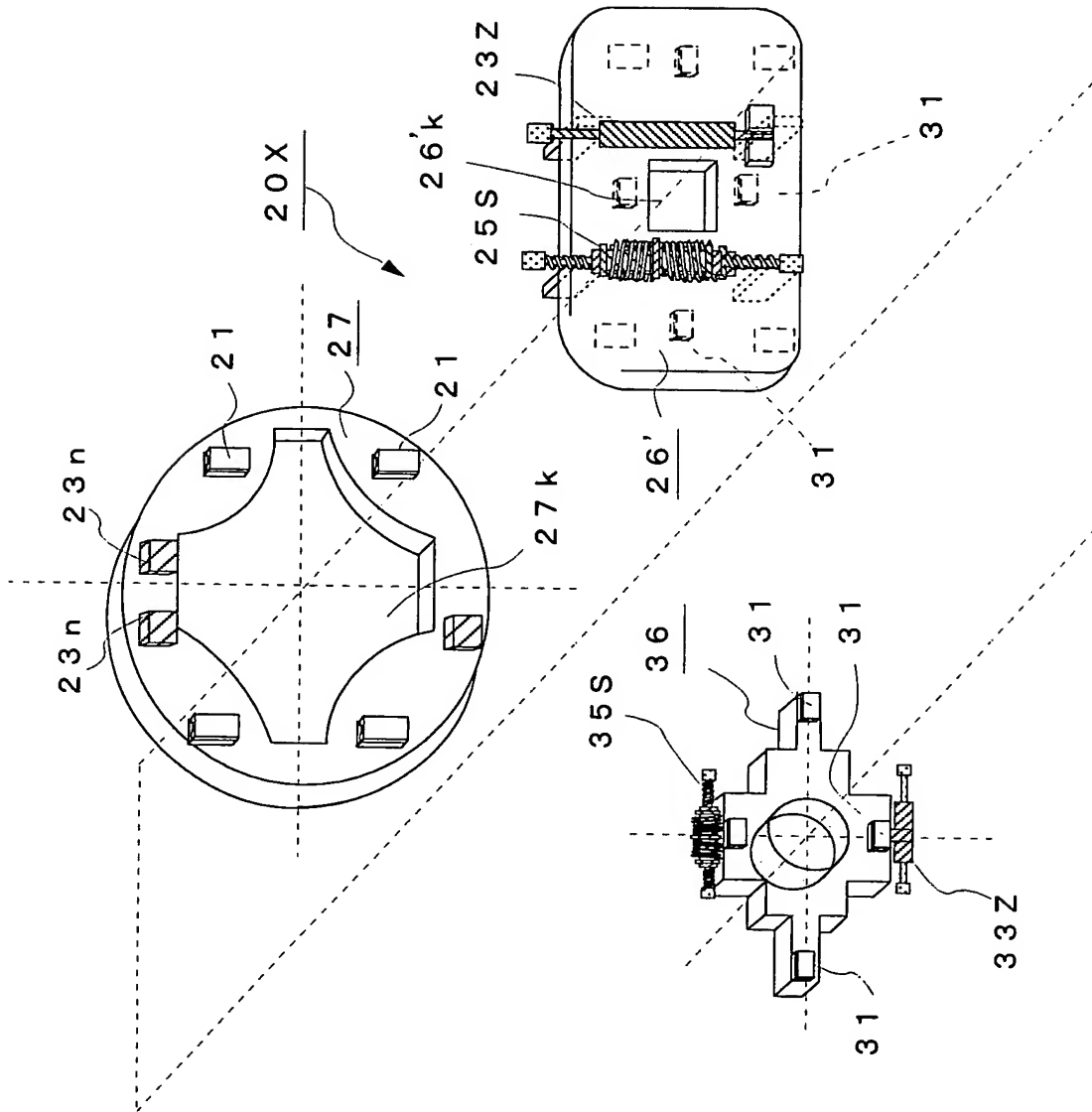


FIG. 36

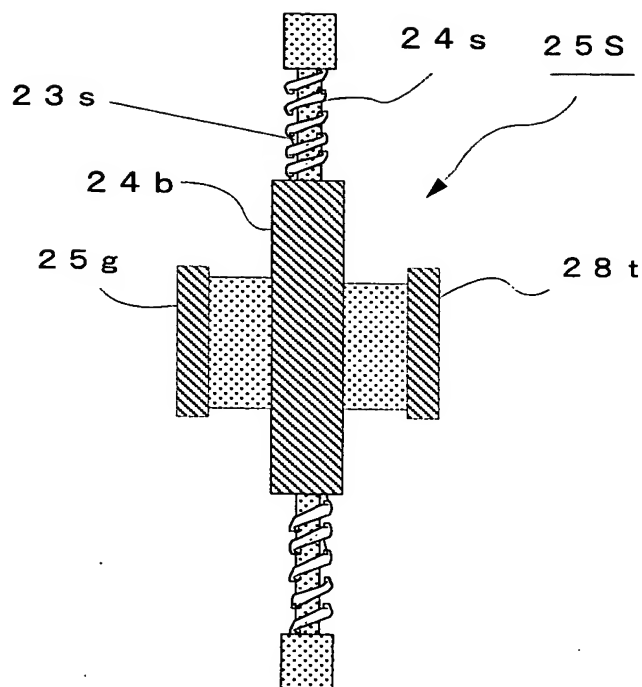


FIG. 37

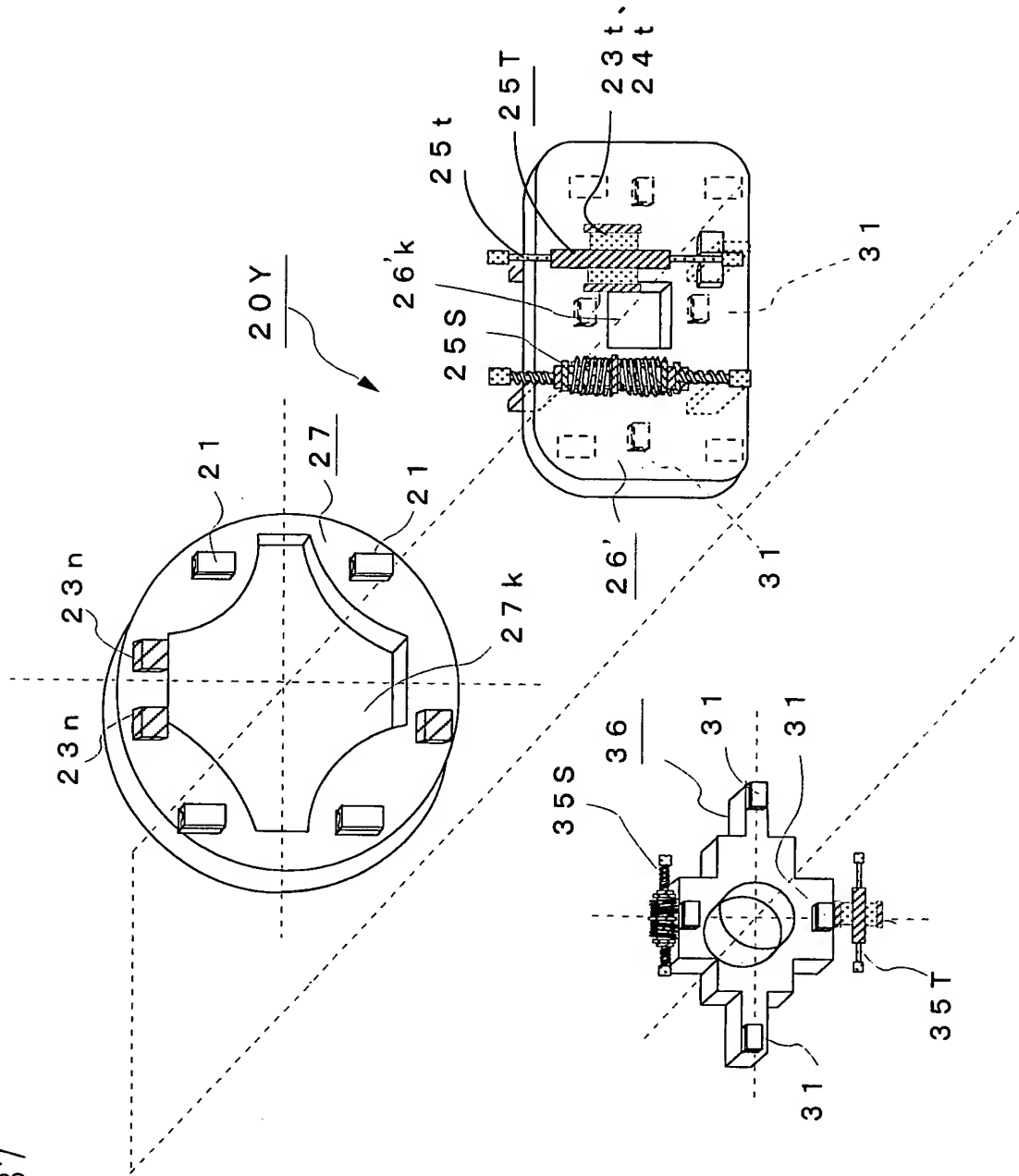


FIG. 38

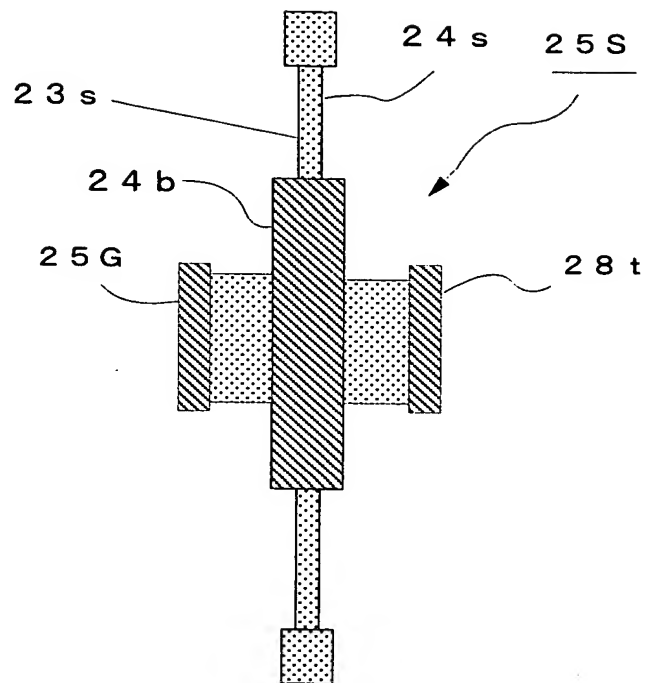


FIG. 39

| TYPE                    | COMPARATIVE<br>EXAMPLE 1 | COMPARATIVE<br>EXAMPLE 2 | COMPARATIVE<br>EXAMPLE 3 | EXAMPLE 1 | EXAMPLE 2                       | EXAMPLE 3 | EXAMPLE 4                              |
|-------------------------|--------------------------|--------------------------|--------------------------|-----------|---------------------------------|-----------|--|
|                         | CAR MOUNTED              | I WM                     | DD-I WM                  | DD-I WM   | DD-I WM                         | DD-I WM   | DD-I WM                                |
| MOTOR SUPPORTING METHOD | —                        | —                        | k 3, c3                  | k 3, D1   | k 3, D1<br>CYLINDER ADDED TO m5 | k 3, D2   | k 3, D2<br>CYLINDER ADDED<br>TO m4, m5 |
| m1 (kg)                 | 40                       | 70                       | 40                       | 40        | 40                              | 40        | 40                                     |
| m2 (kg)                 | 350                      | 300                      | 300                      | 300       | 300                             | 300       | 300                                    |
| m3 (kg)                 | —                        | —                        | 32                       | 32        | 30                              | 32        | 30                                     |
| m4 (kg)                 | —                        | —                        | —                        | —         | —                               | —         | 1                                      |
| m5 (kg)                 | —                        | —                        | —                        | —         | 2                               | —         | 1                                      |
| k1 (N/m)                | 360000                   | 360000                   | 360000                   | 360000    | 360000                          | 360000    | 360000                                 |
| k2 (N/m)                | 32000                    | 32000                    | 32000                    | 32000     | 32000                           | 32000     | 32000                                  |
| k3 (N/m)                | —                        | —                        | 39200                    | 140000    | 210000                          | 90000     | 120000                                 |
| k4 (N/m)                | —                        | —                        | —                        | —         | —                               | 120000    | 90000                                  |
| k5 (N/m)                | —                        | —                        | —                        | 40000     | 40000                           | 40000     | 40000                                  |
| c1 (N/(m/s))            | 50                       | 50                       | 50                       | 50        | 50                              | 50        | 50                                     |
| c2 (N/(m/s))            | 1500                     | 1500                     | 1500                     | 1500      | 1500                            | 1500      | 1500                                   |
| c3 (N/(m/s))            | —                        | —                        | 1000                     | 300       | —                               | 700       | 500                                    |
| c4 (N/(m/s))            | —                        | —                        | —                        | —         | —                               | 50        | 50                                     |
| c5 (N/(m/s))            | —                        | —                        | —                        | 1500      | 1700                            | 1500      | 1500                                   |

D 1 ; COMPOSITE CONNECTION DAMPER, D 2 ; SECOND COMPOSITE CONNECTION DAMPER

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FIG. 40 (a) PRIOR ART

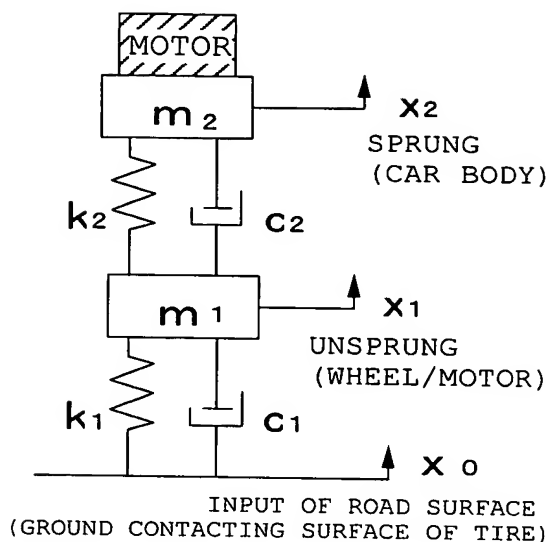


FIG. 40 (b) PRIOR ART

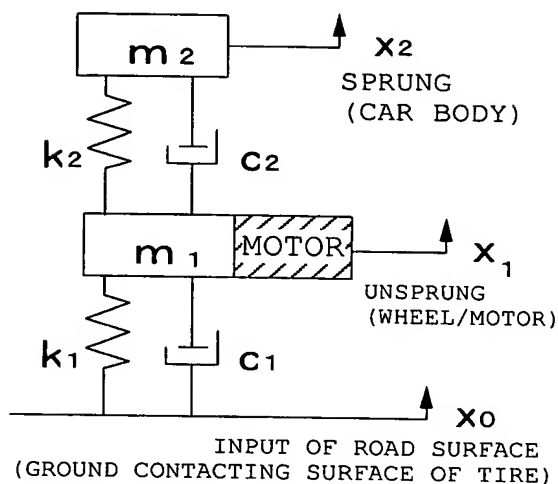


FIG. 41 PRIOR ART

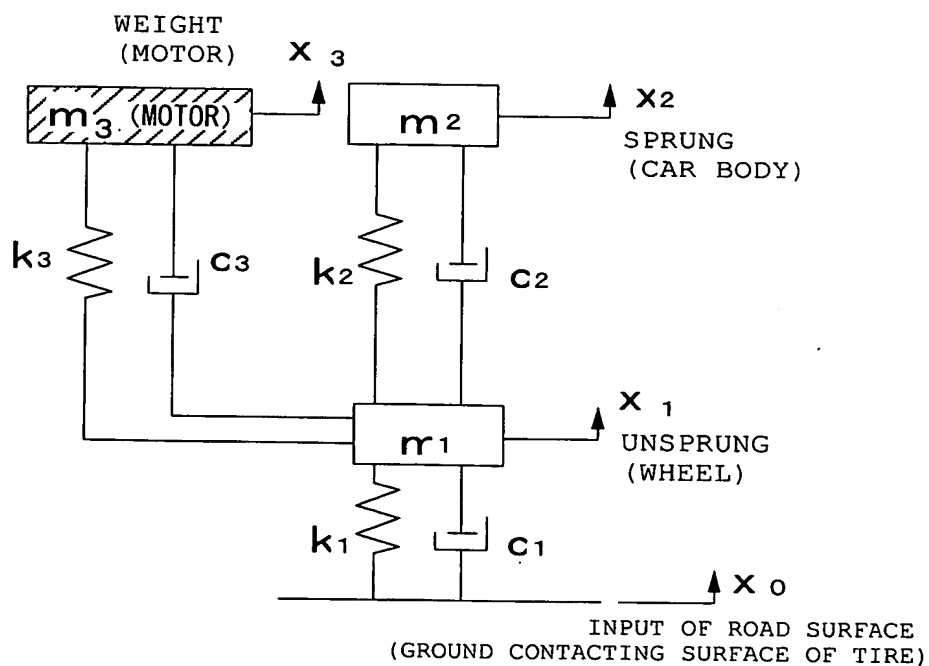


FIG. 42

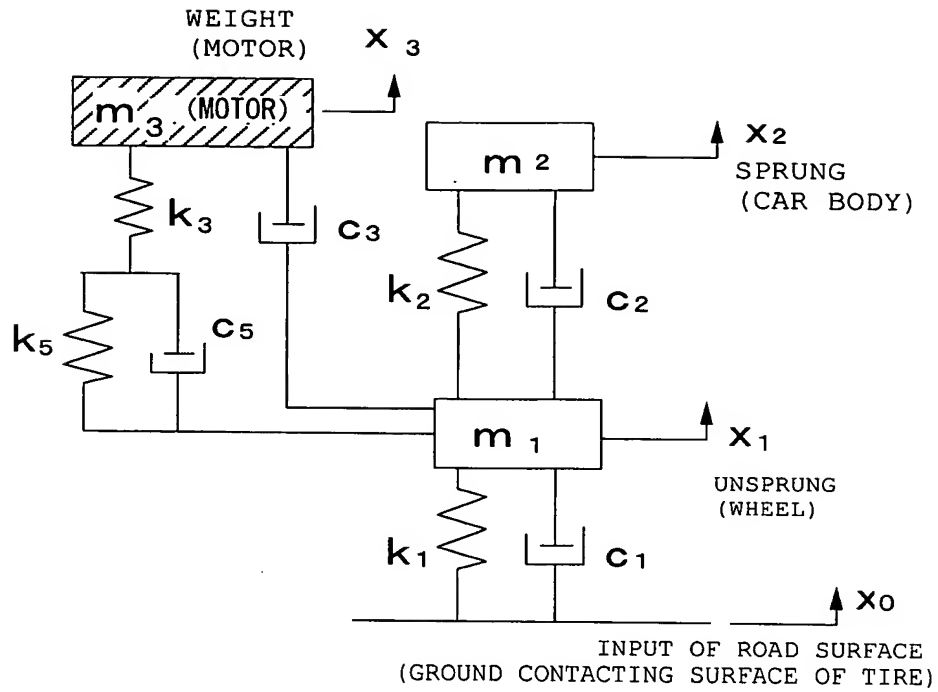


FIG. 43

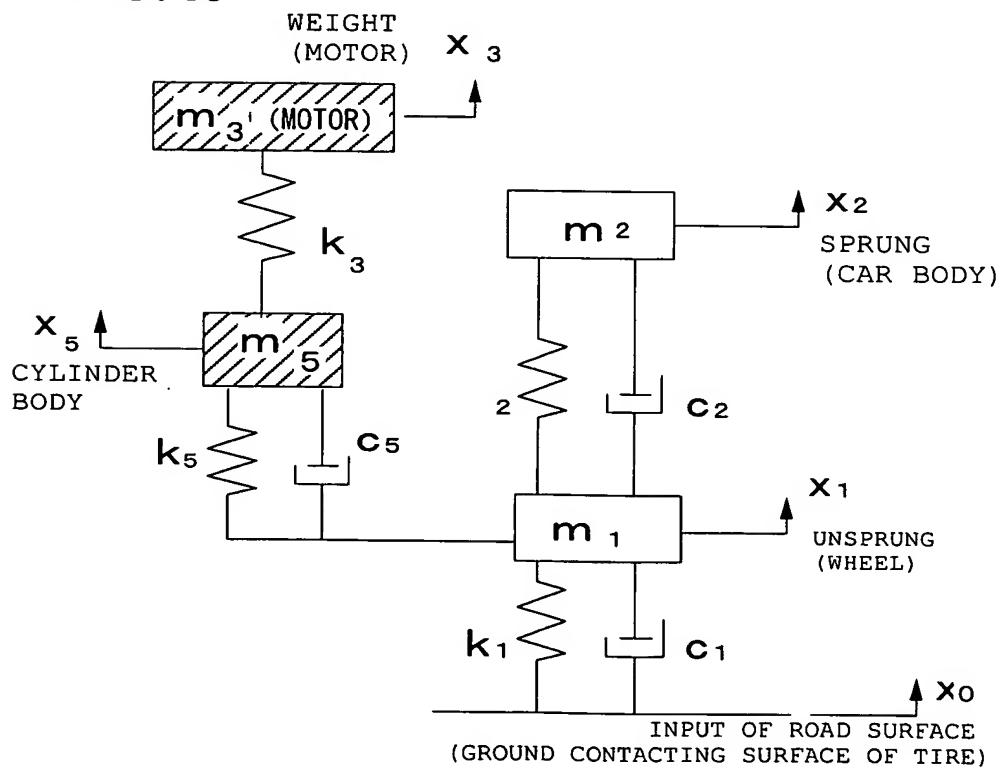




FIG. 44

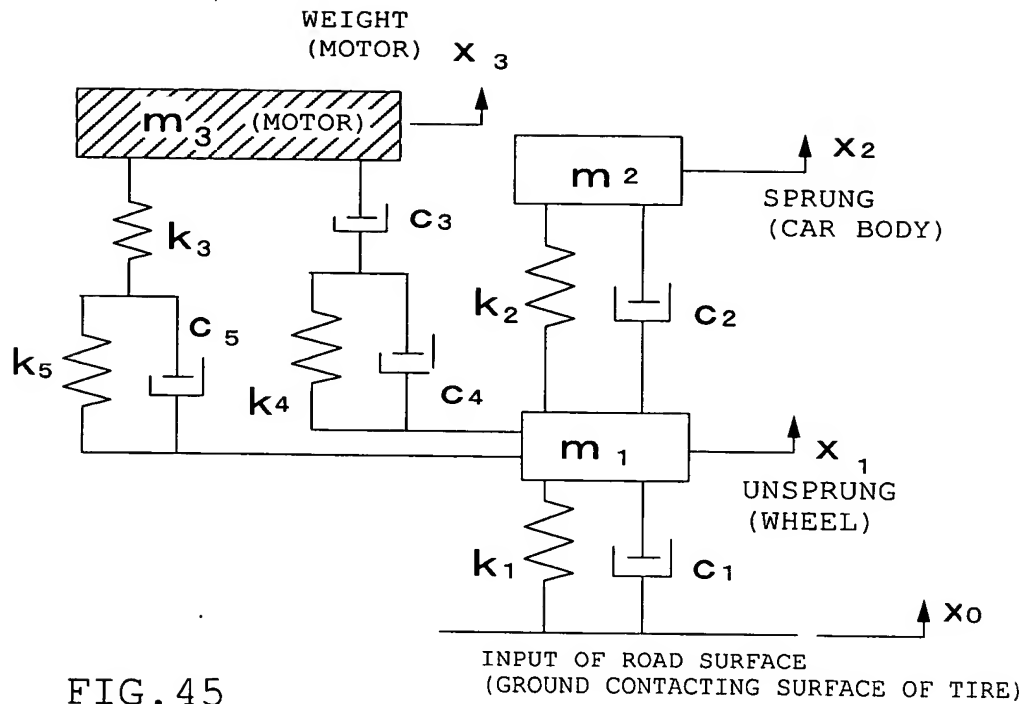


FIG. 45

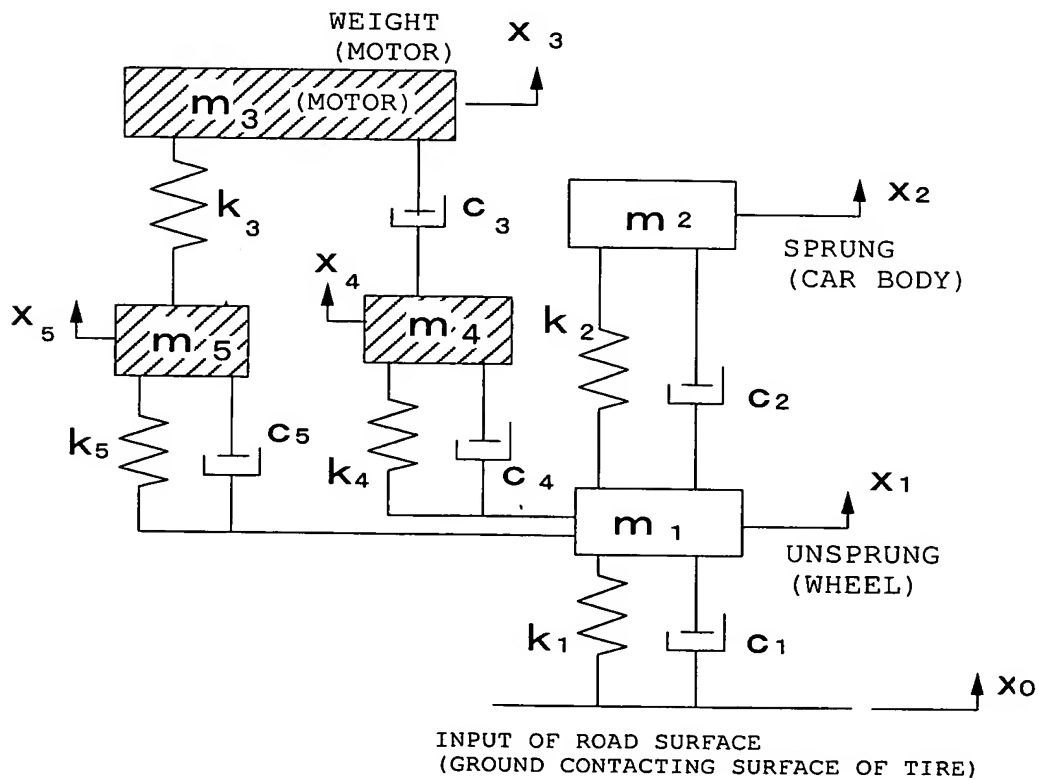


FIG. 46

VARIATIONS IN  
GROUND-CONTACT LOAD  
OF TIRE (N/Hz)

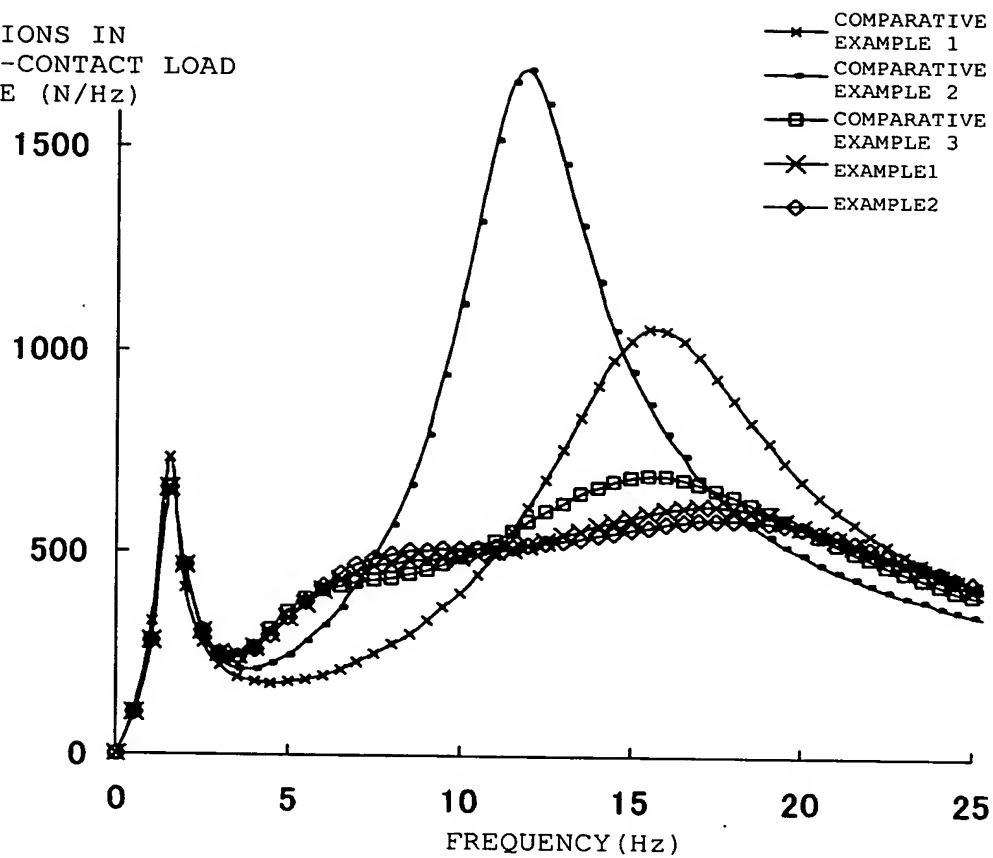


FIG. 47

VARIATIONS IN  
GROUND-CONTACT LOAD  
OF TIRE (N/Hz)

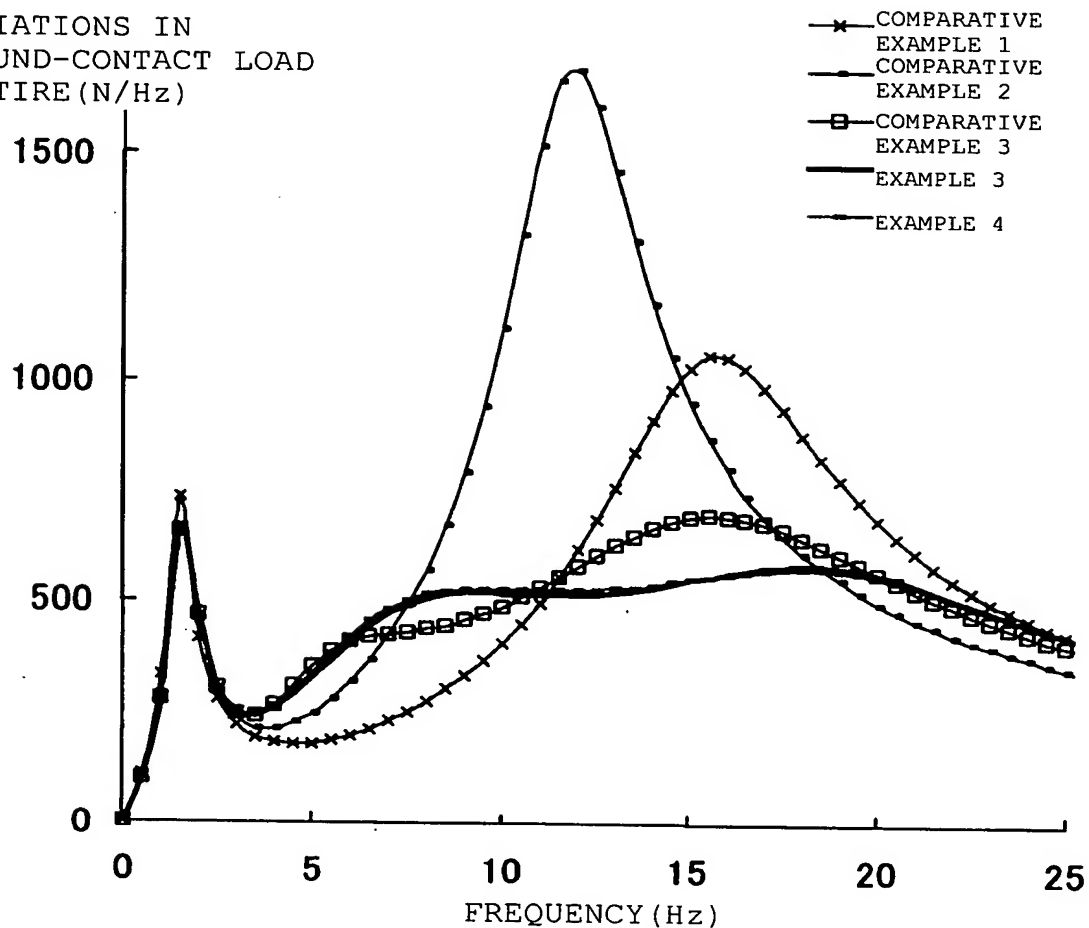


FIG. 48

|                         | COMPARATIVE<br>EXAMPLE 1 | COMPARATIVE<br>EXAMPLE 2 | COMPARATIVE<br>EXAMPLE 3 | EXAMPLE 1 | EXAMPLE 2                          | EXAMPLE 3 | EXAMPLE 4                              |
|-------------------------|--------------------------|--------------------------|--------------------------|-----------|------------------------------------|-----------|--|
| TYPE                    | CAR MOUNTED              | IWM                      | DD-IWM                   | DD-IWM    | DD-IWM                             | DD-IWM    | DD-IWM                                 |
| MOTOR SUPPORTING METHOD | —                        | —                        | k 3, c3                  | k 3, D1   | k 3, D1<br>CYLINDER ADDED<br>TO m5 | k 3, D2   | k 3, D2<br>CYLINDER ADDED<br>TO m4, m5 |
| m1 (kg)                 | 40                       | 70                       | 40                       | 40        | 40                                 | 40        | 40                                     |
| m2 (kg)                 | 350                      | 300                      | 300                      | 300       | 300                                | 300       | 300                                    |
| m3 (kg)                 | —                        | —                        | 32                       | 32        | 30                                 | 32        | 30                                     |
| m4 (kg)                 | —                        | —                        | —                        | —         | —                                  | —         | 1                                      |
| m5 (kg)                 | —                        | —                        | —                        | —         | 2                                  | —         | 1                                      |
| k 1 (N/m)               | 670000                   | 670000                   | 670000                   | 670000    | 670000                             | 670000    | 670000                                 |
| k 2 (N/m)               | 100000                   | 100000                   | 100000                   | 100000    | 100000                             | 100000    | 100000                                 |
| k 3 (N/m)               | —                        | —                        | 60000                    | 140000    | 450000                             | 400000    | 400000                                 |
| k 4 (N/m)               | —                        | —                        | —                        | —         | —                                  | 60000     | 60000                                  |
| k 5 (N/m)               | —                        | —                        | —                        | 100000    | 60000                              | 40000     | 40000                                  |
| c 1 (N/(m/s))           | 50                       | 50                       | 50                       | 50        | 50                                 | 50        | 50                                     |
| c 2 (N/(m/s))           | 1200                     | 1200                     | 1200                     | 1200      | 1200                               | 1200      | 1200                                   |
| c 3 (N/(m/s))           | —                        | —                        | 1100                     | 1200      | —                                  | 1200      | 1200                                   |
| c 4 (N/(m/s))           | —                        | —                        | —                        | —         | —                                  | 50        | 50                                     |
| c 5 (N/(m/s))           | —                        | —                        | —                        | 2000      | 2200                               | 1700      | 1700                                   |

D 1 : COMPOSITE CONNECTION DAMPER, D 2 : SECOND COMPOSITE CONNECTION DAMPER

FIG. 49 (a) PRIOR ART

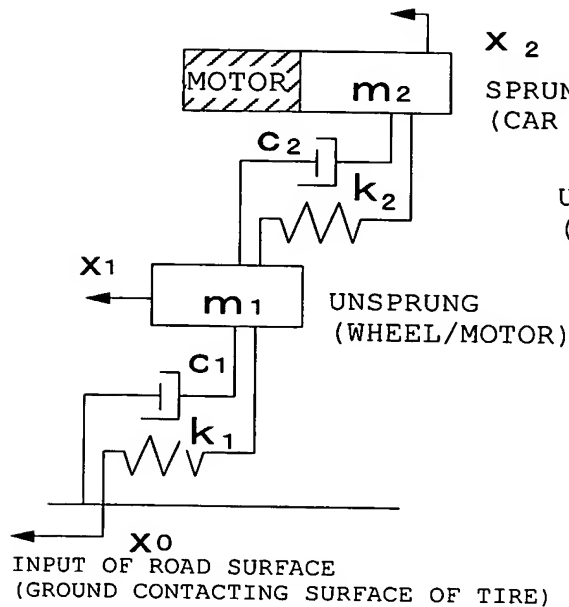


FIG. 49 (b) PRIOR ART

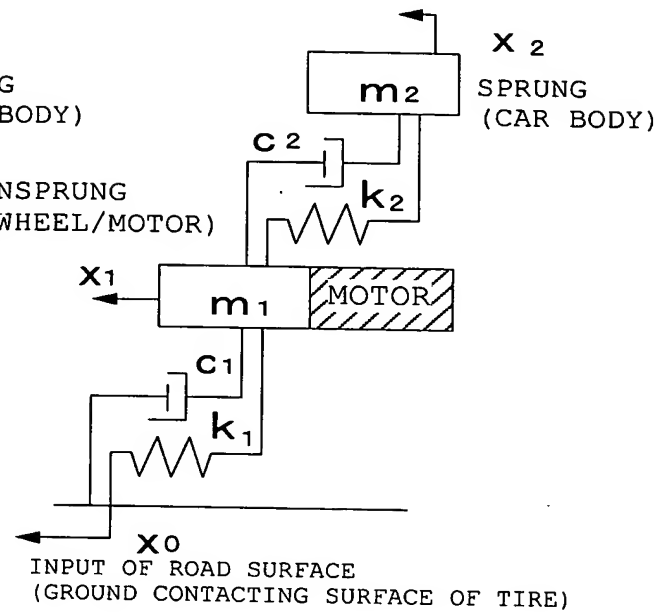


FIG. 50 PRIOR ART

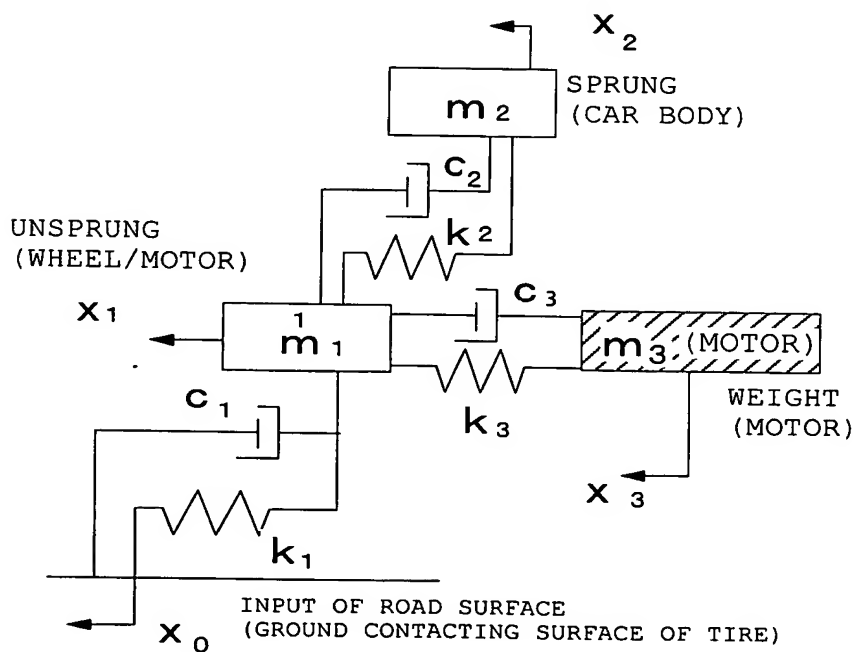


FIG. 51

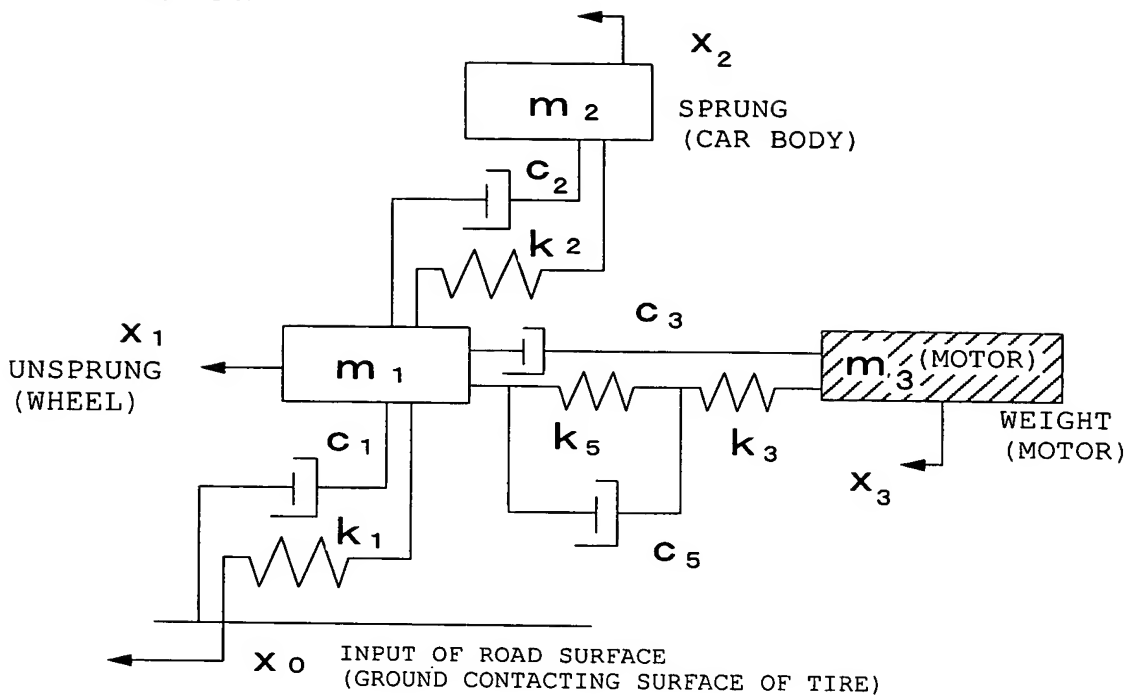


FIG. 52

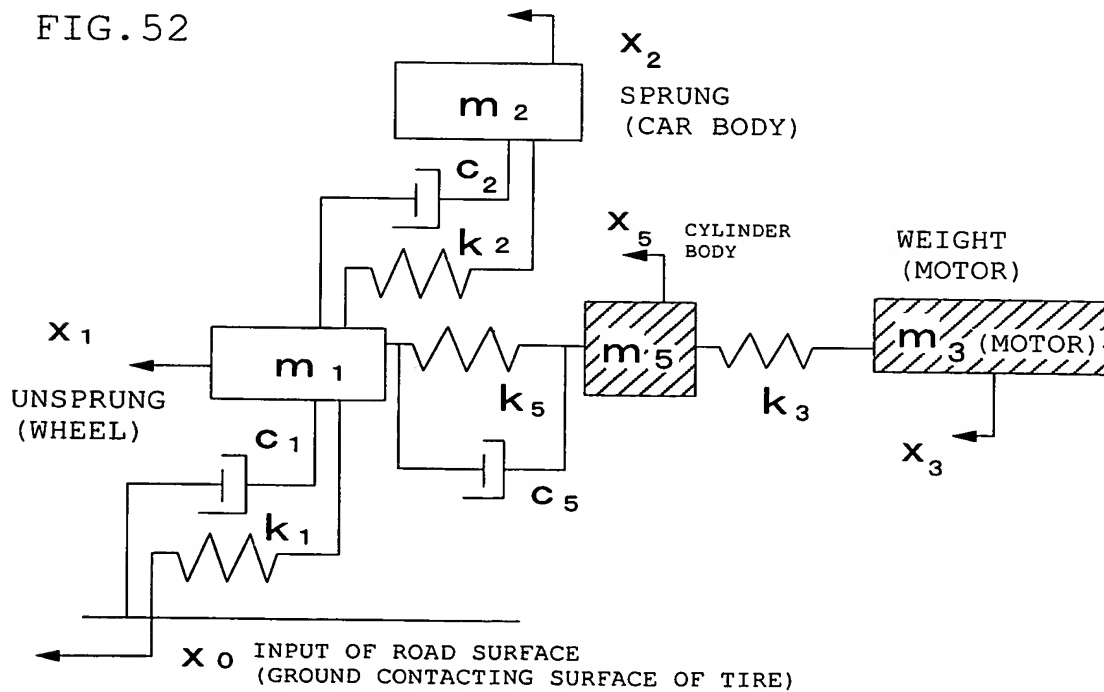


FIG. 53

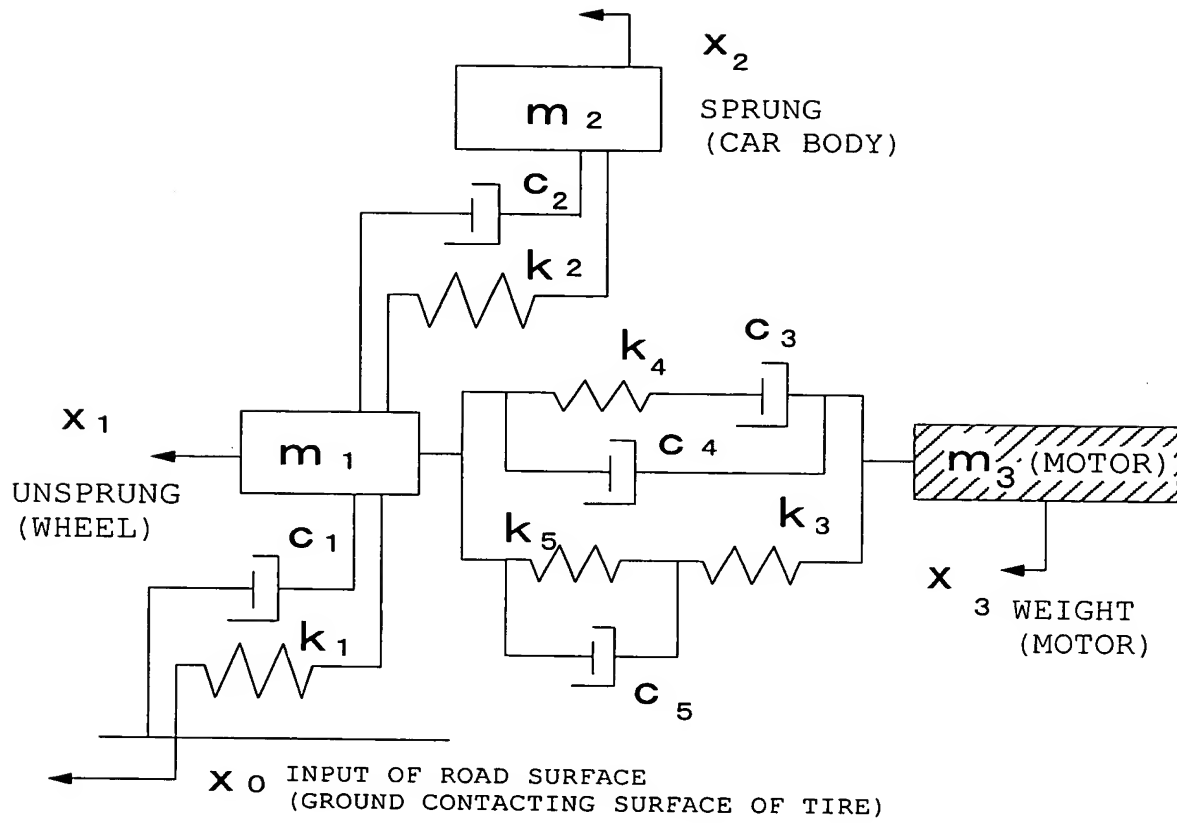


FIG. 54

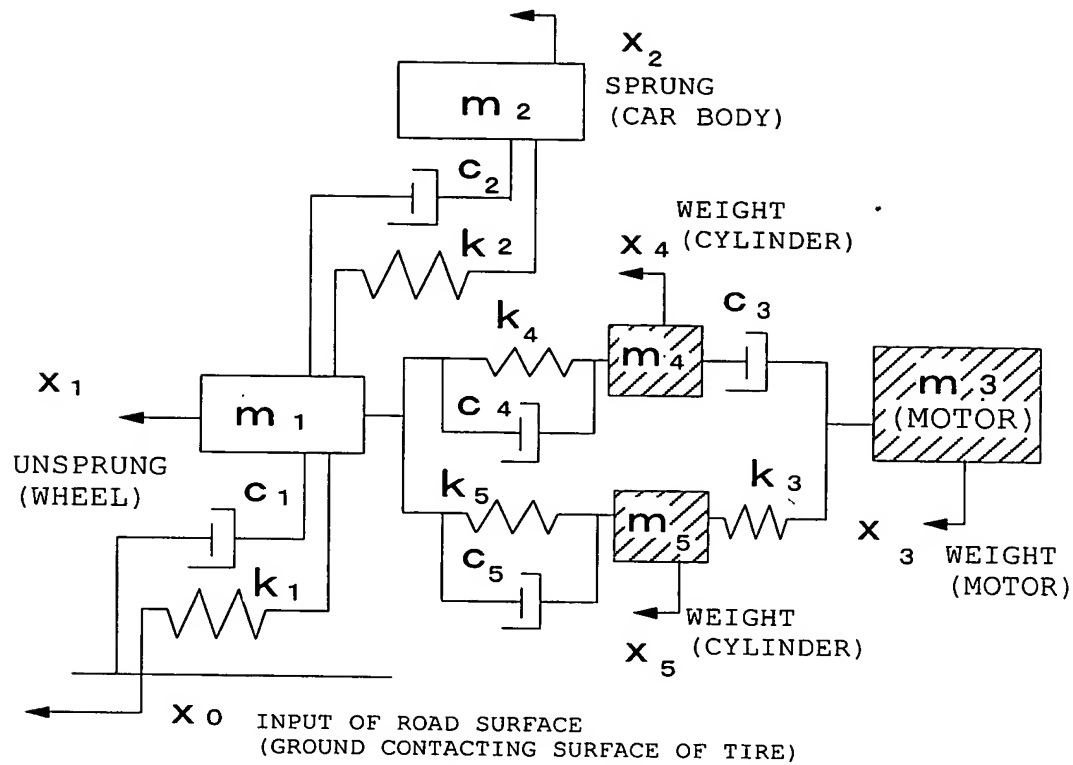




FIG.55

VARIATIONS IN  
LONGITUDINAL FORCE  
OF TIRE (N/Hz)

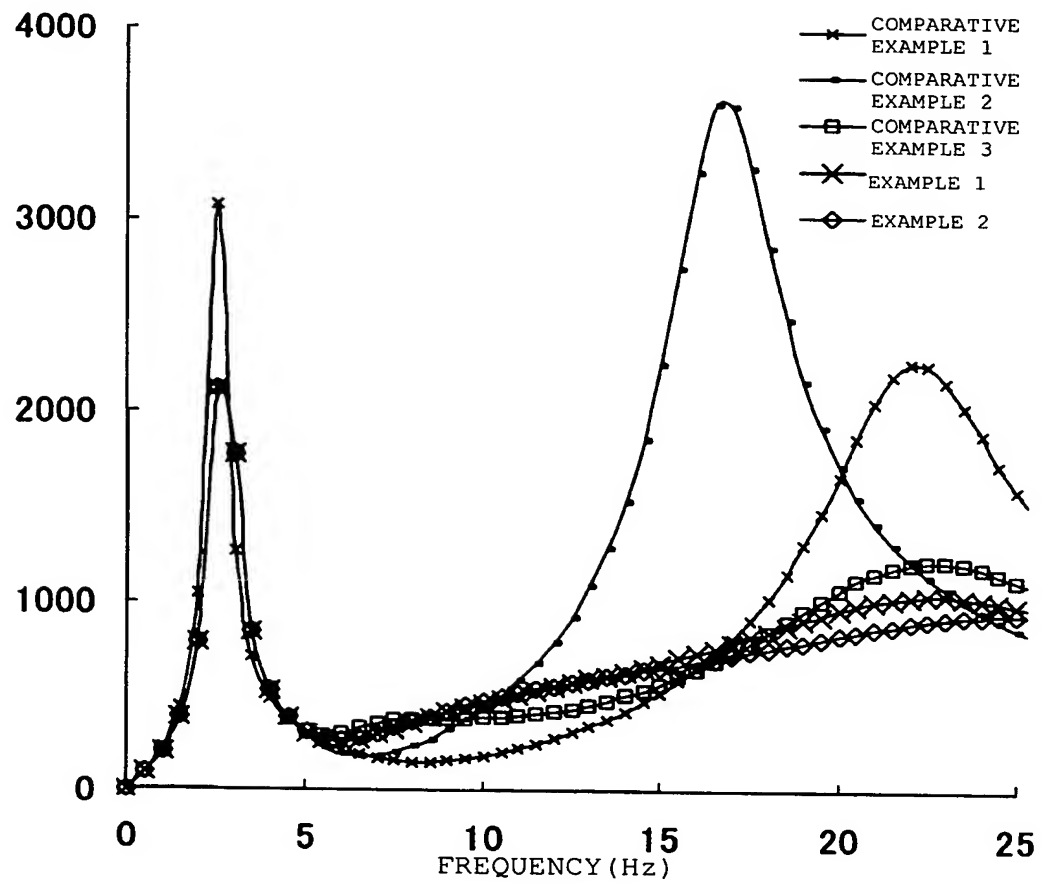


FIG. 56  
VARIATIONS IN  
LONGITUDINAL FORCE  
OF TIRE (N/Hz)

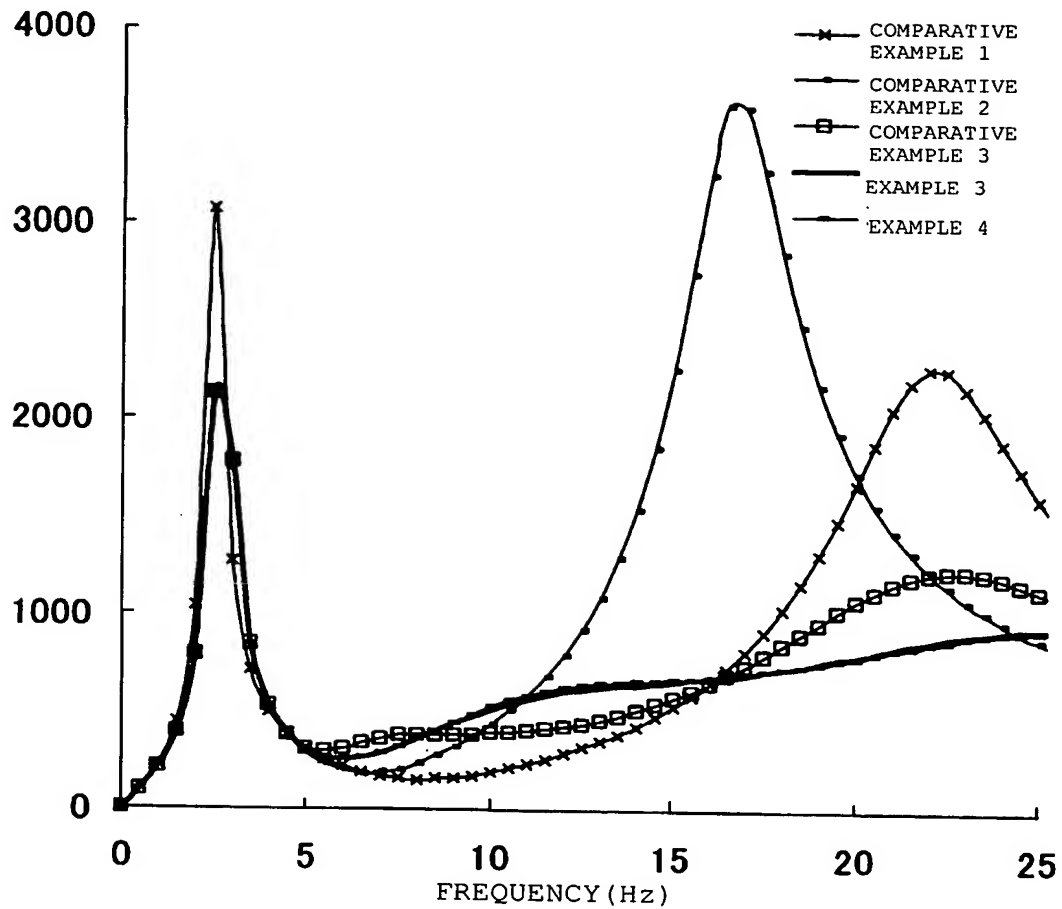




FIG. 58

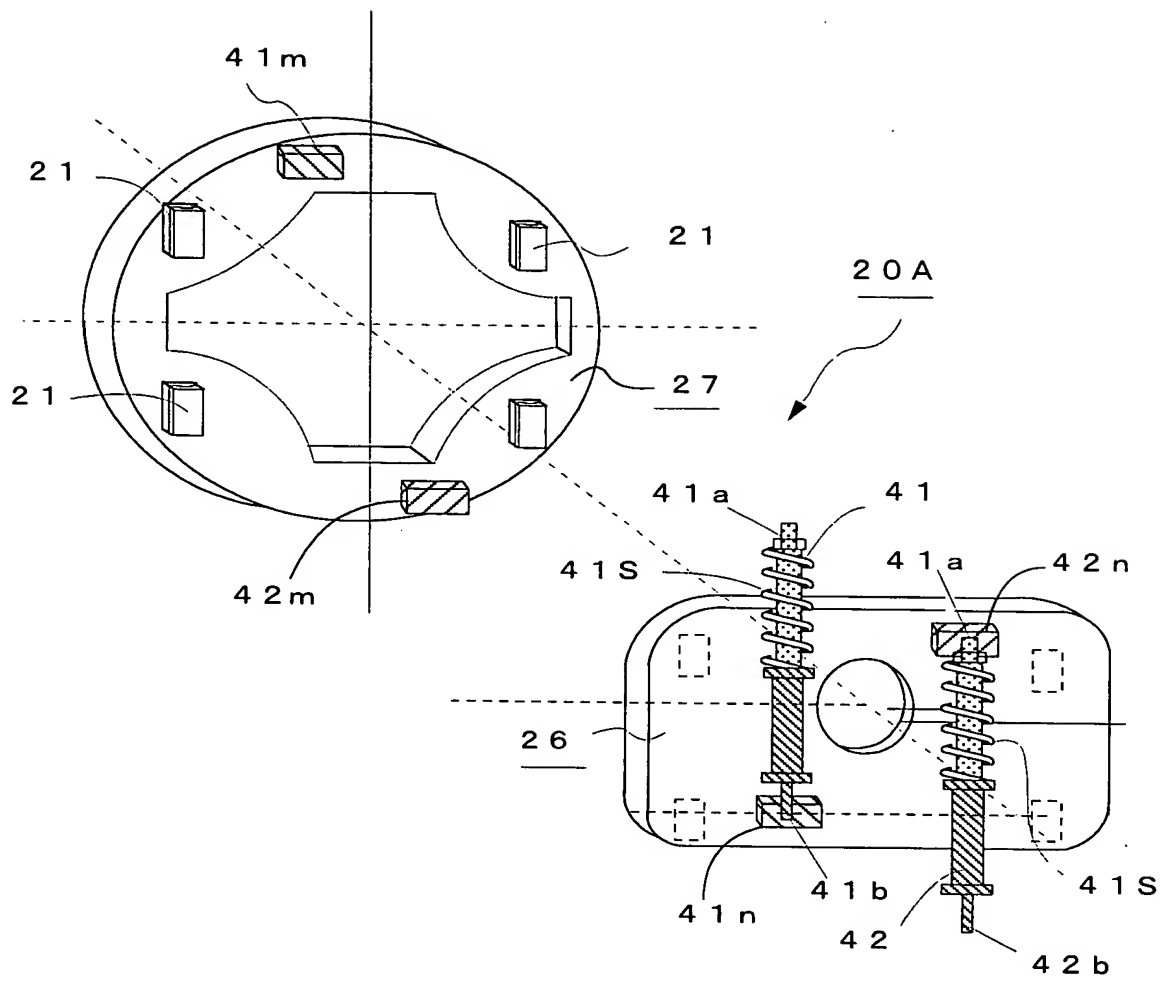


FIG. 59

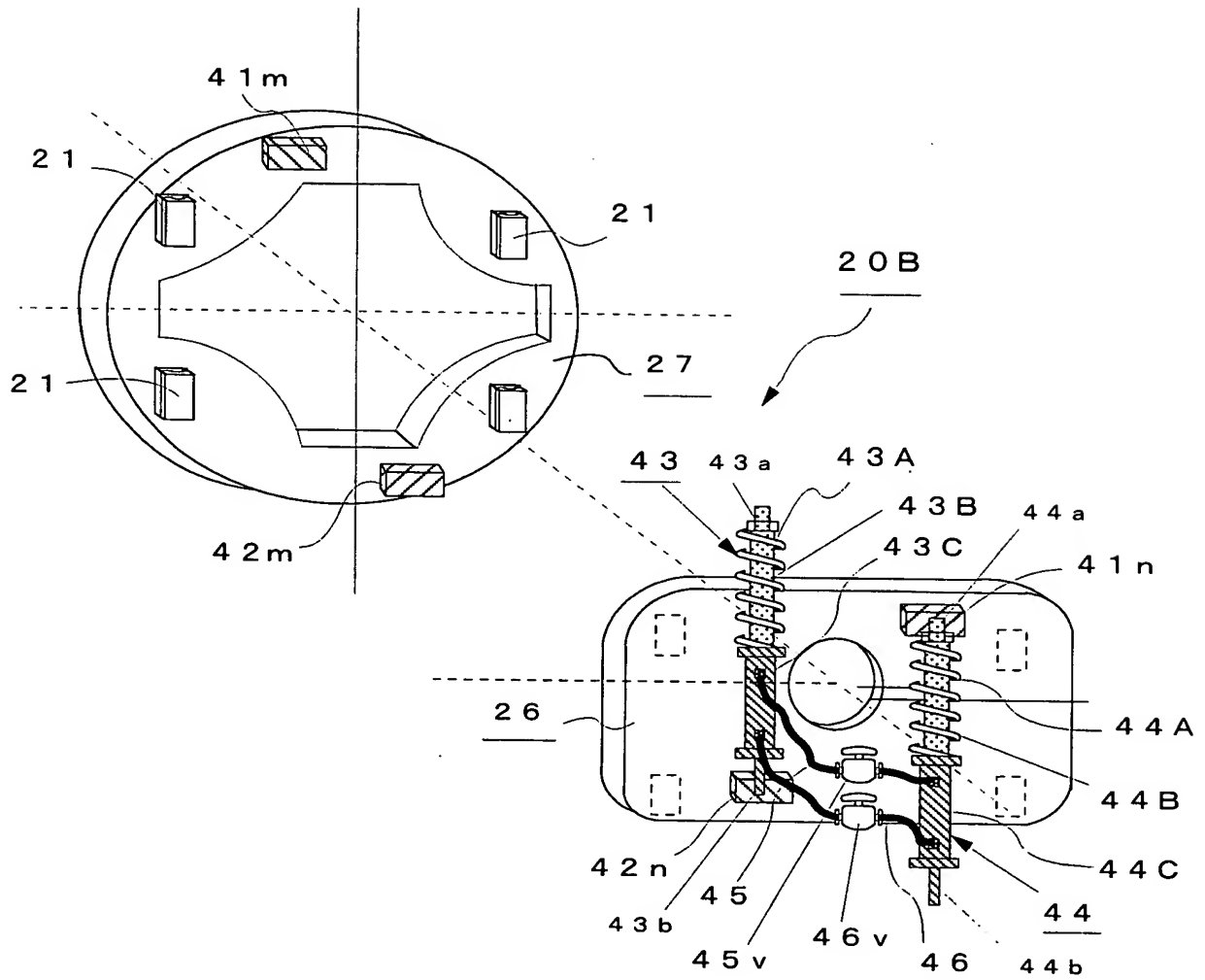


FIG. 60

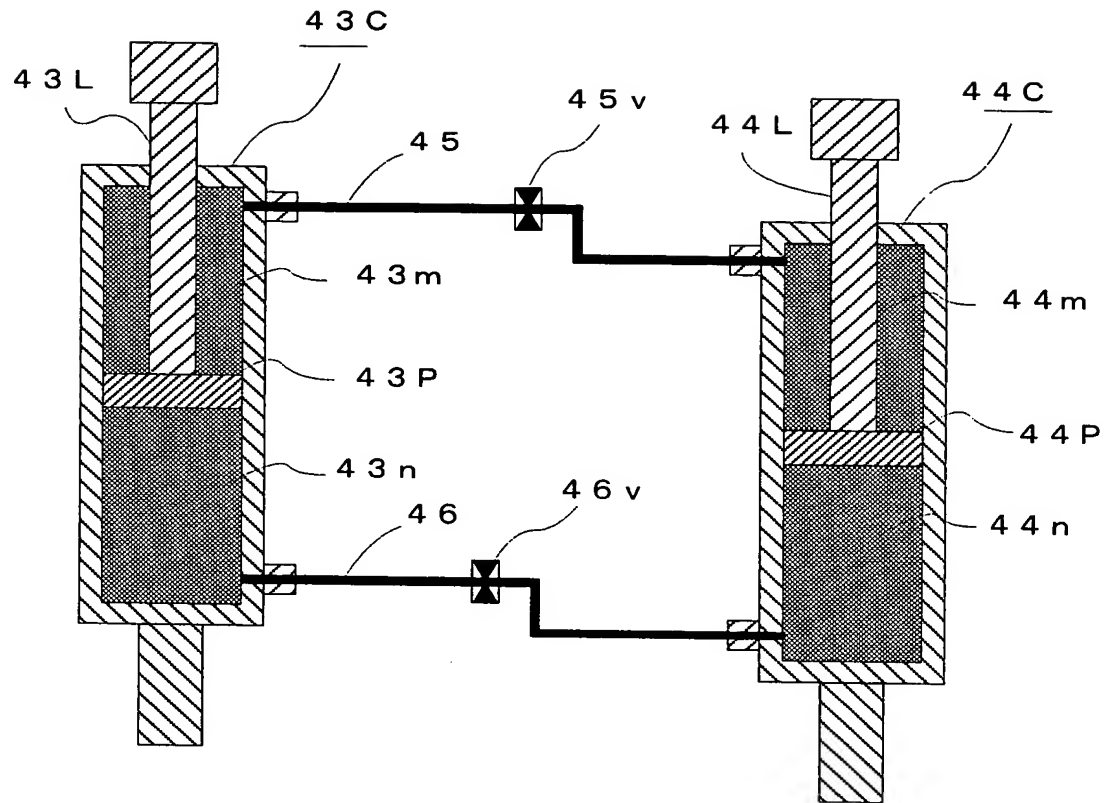


FIG. 61

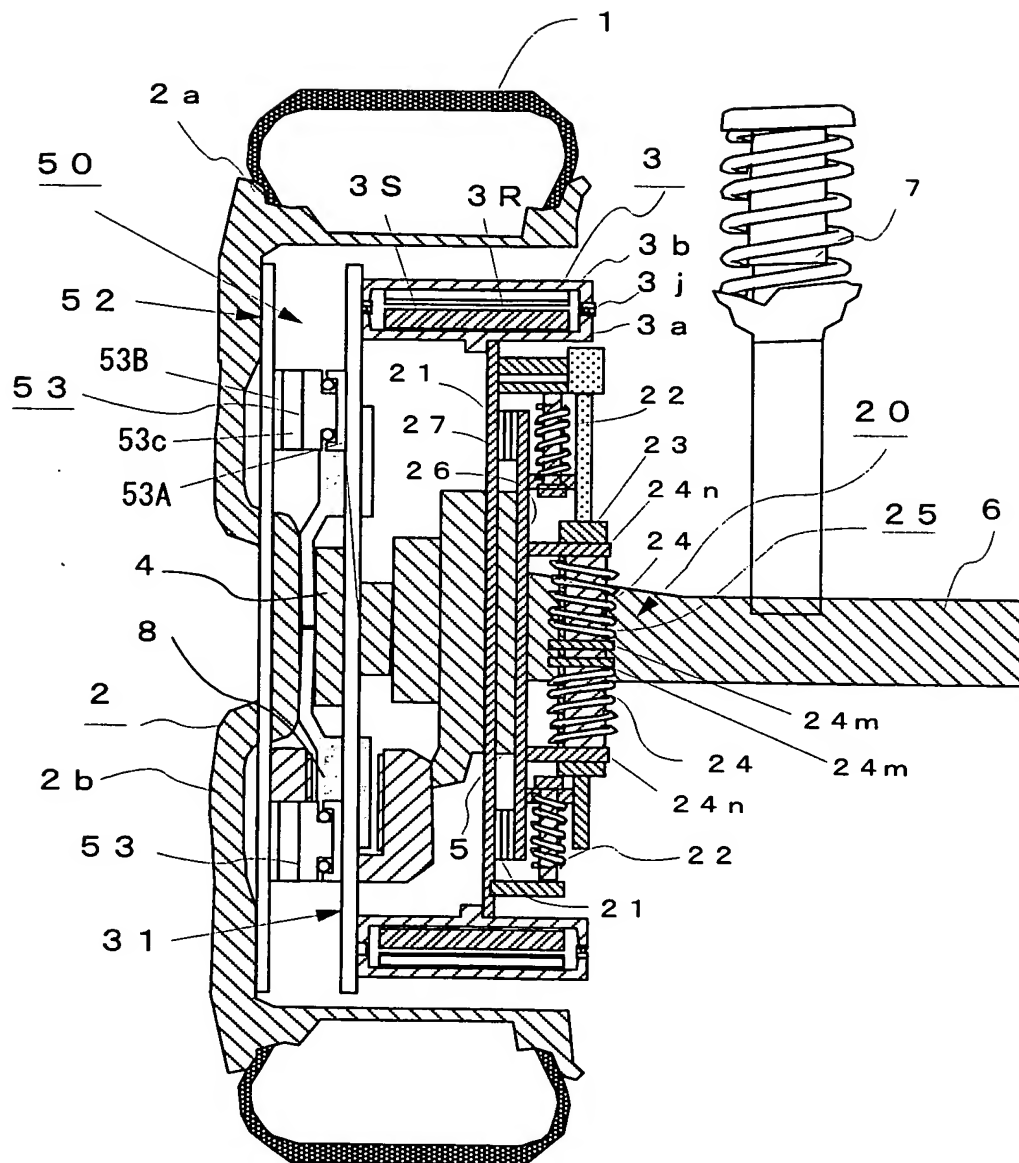


FIG. 62

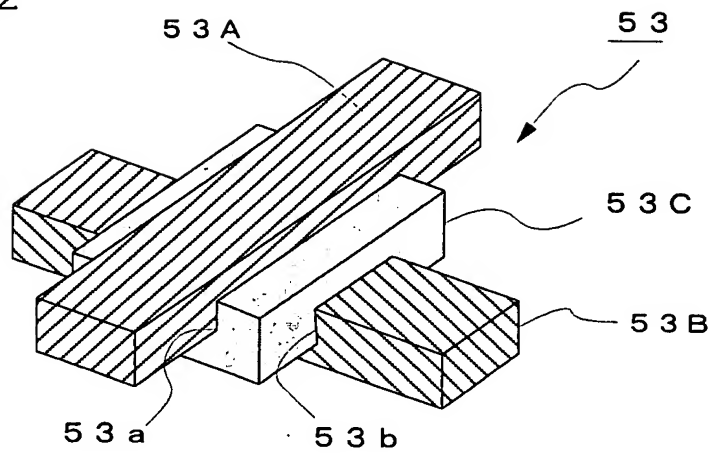


FIG. 63

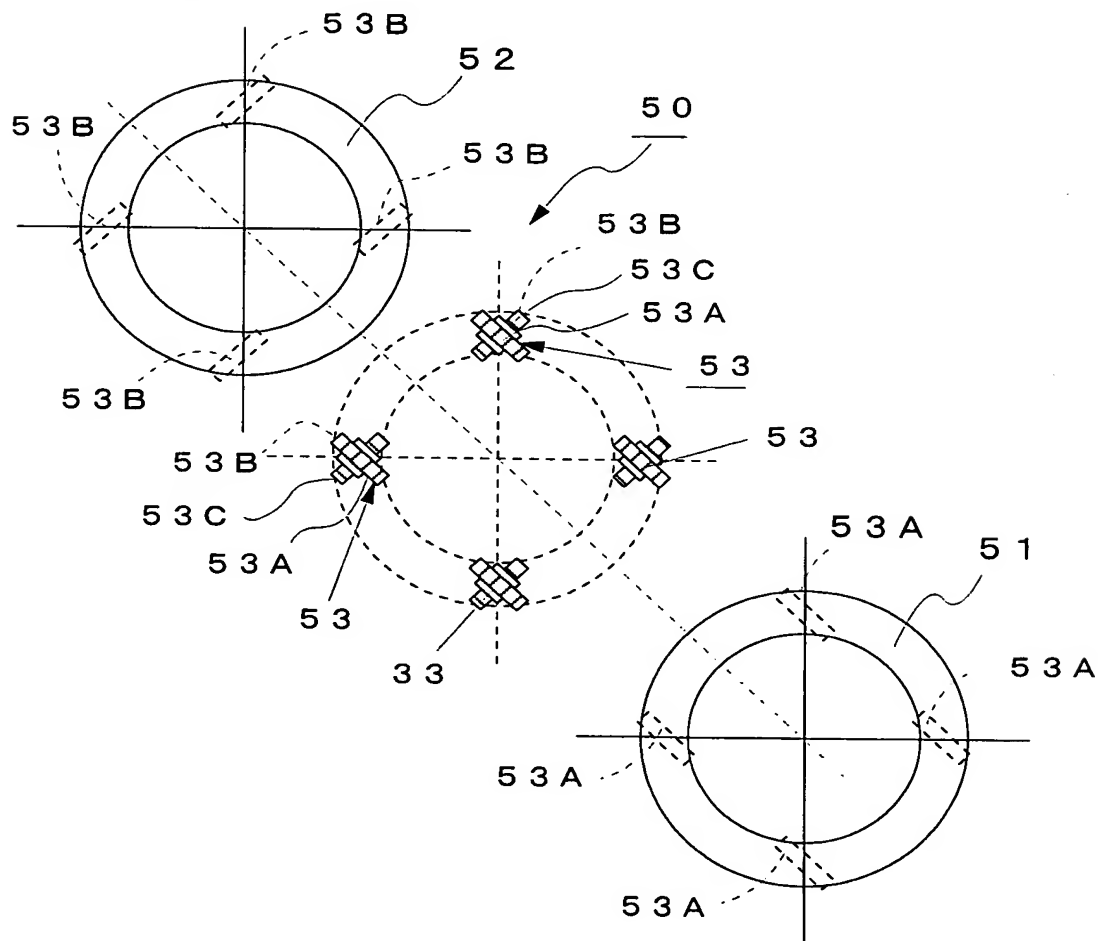




FIG. 64

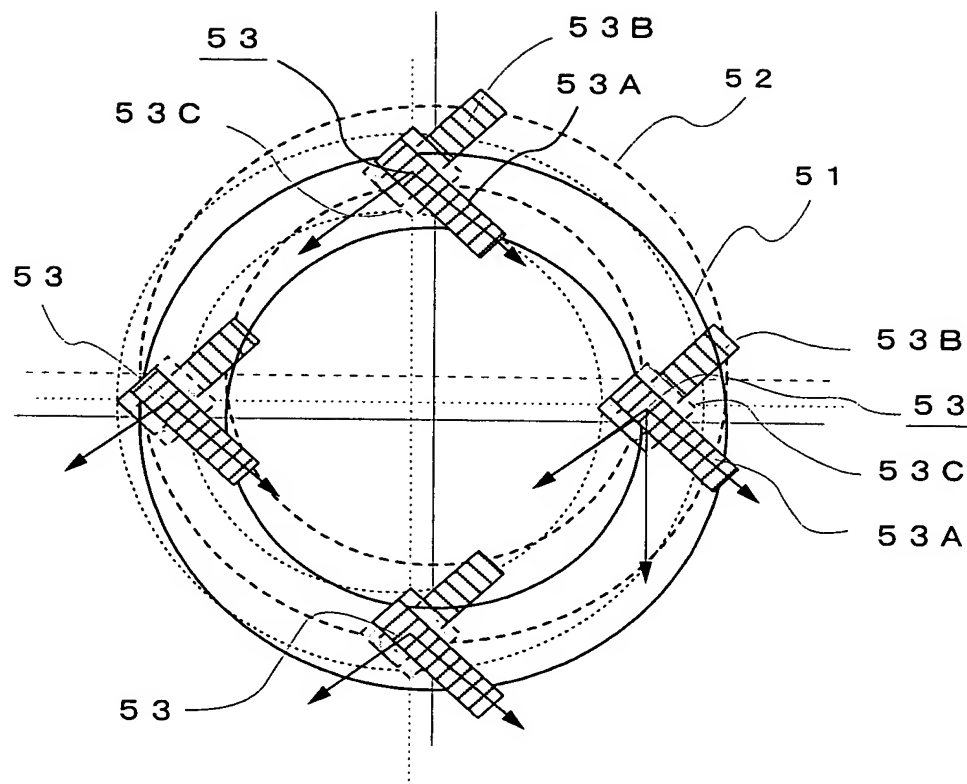


FIG. 65

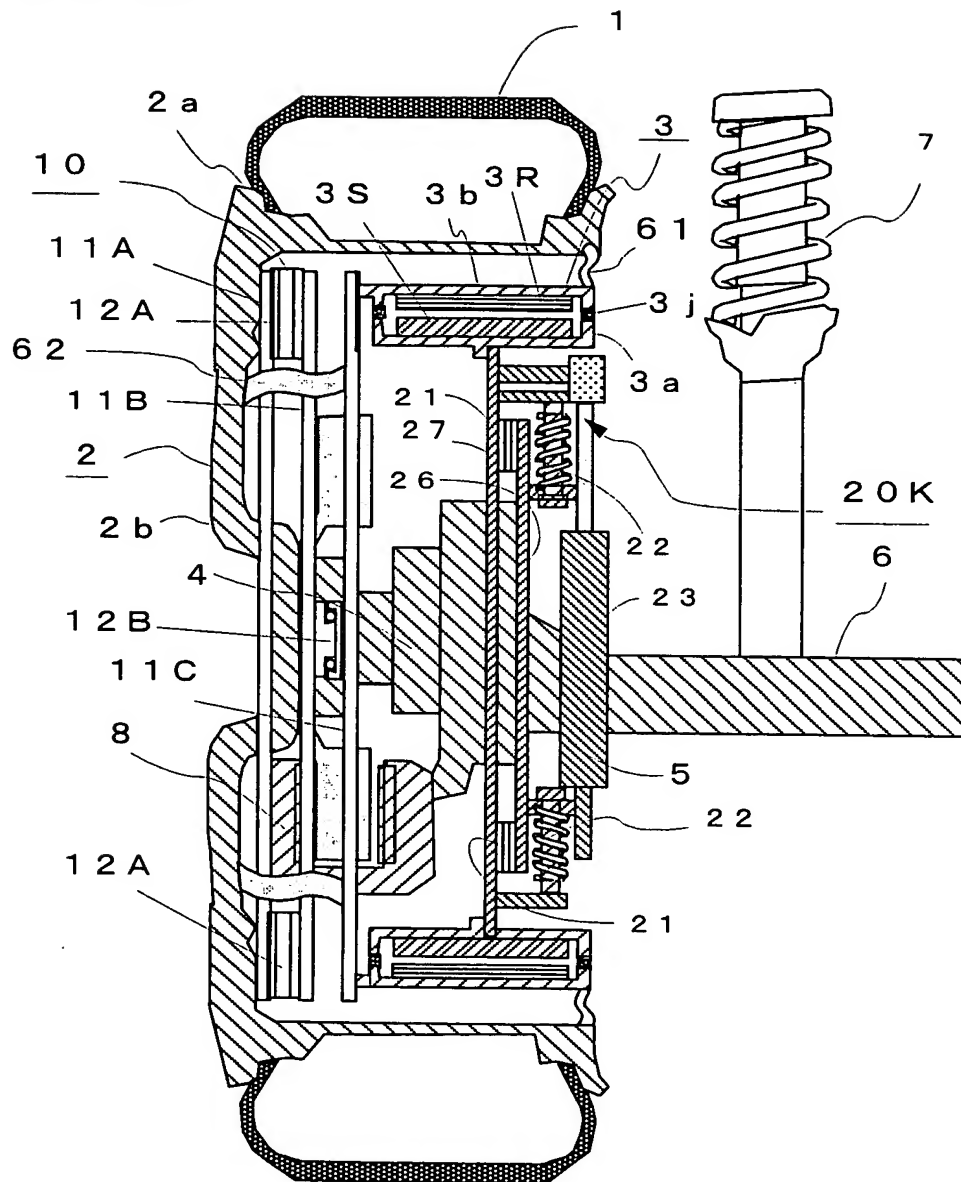


FIG. 66

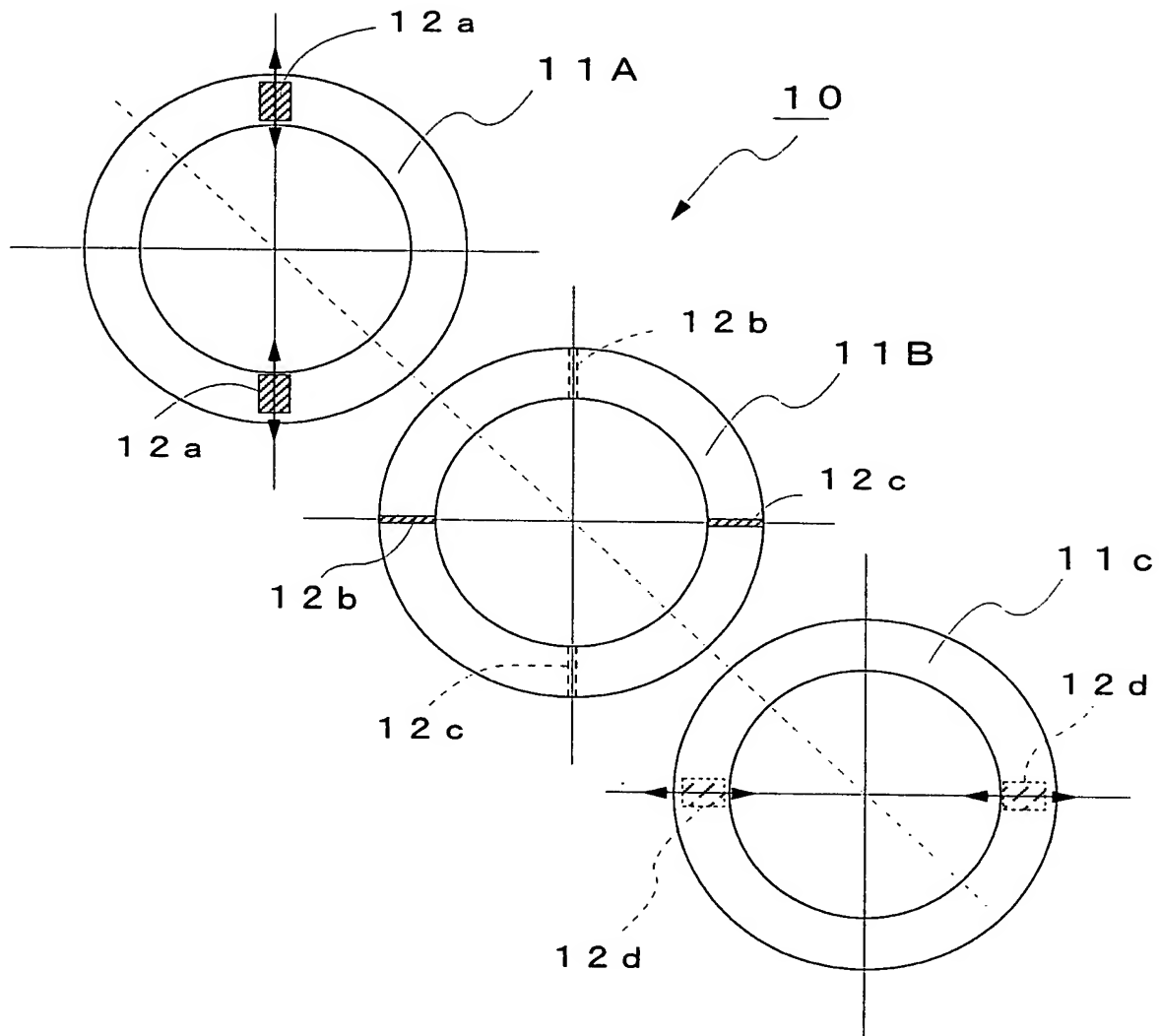


FIG. 67

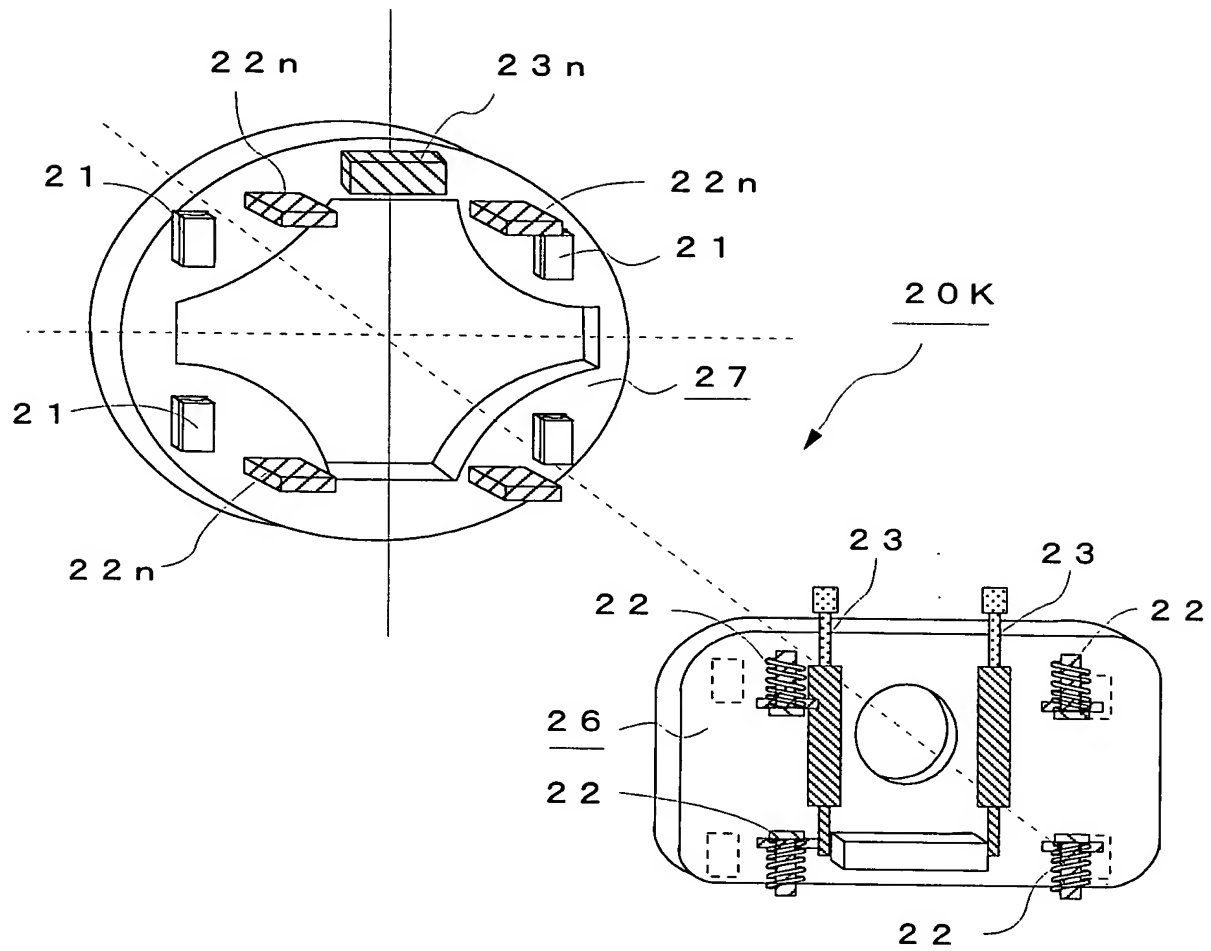


FIG. 68

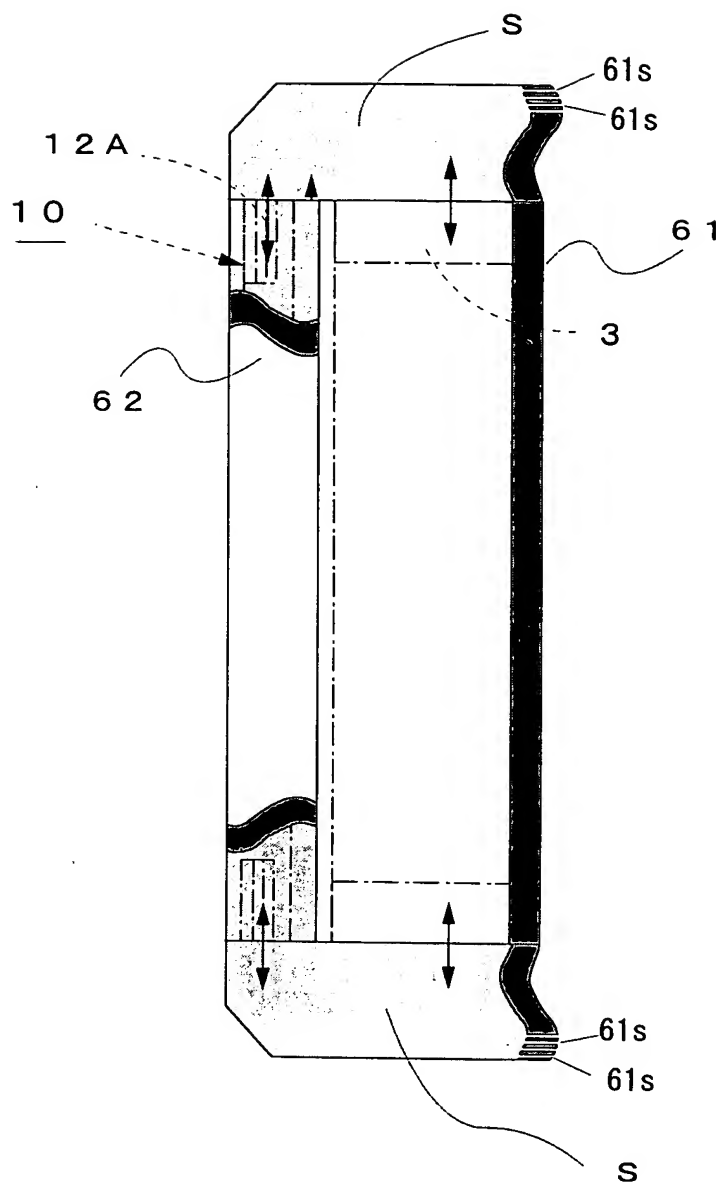


FIG. 69

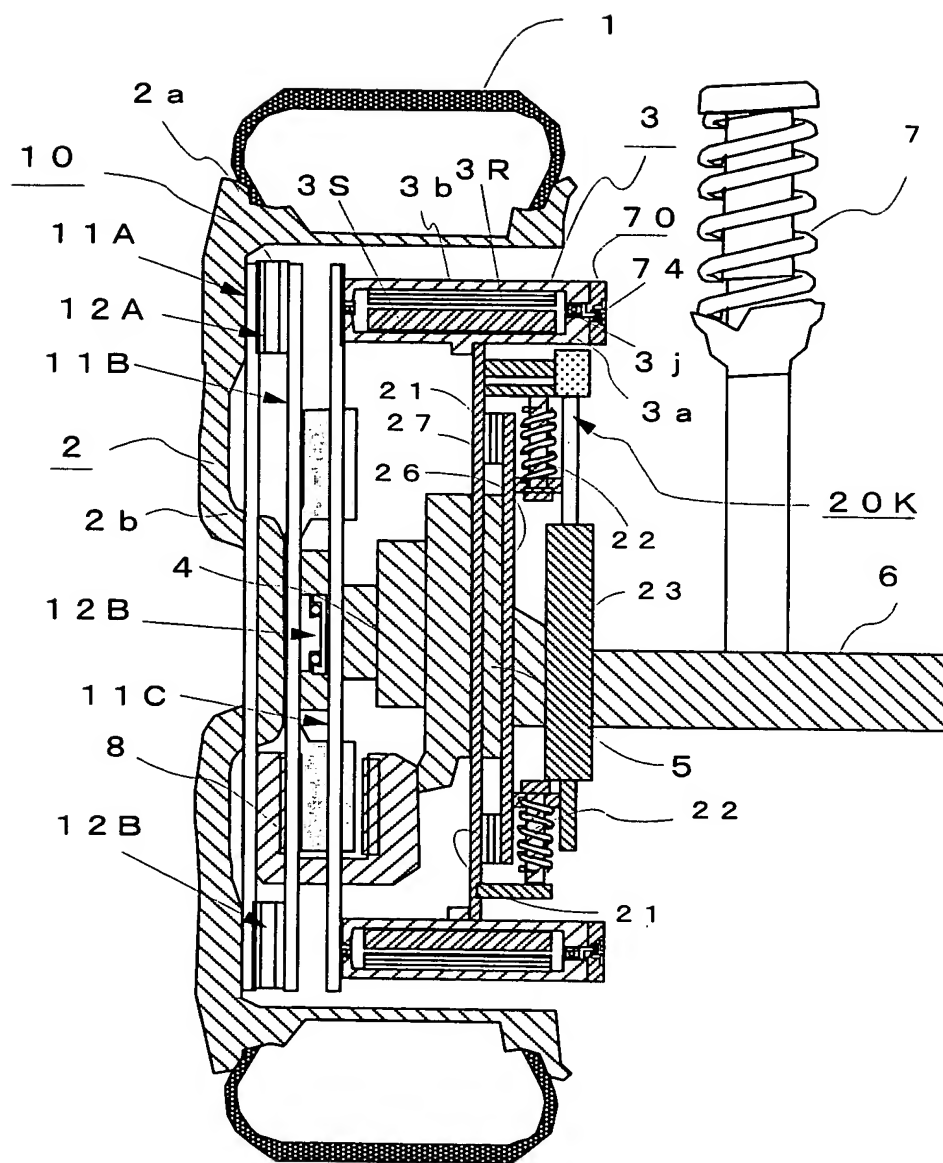


FIG. 70

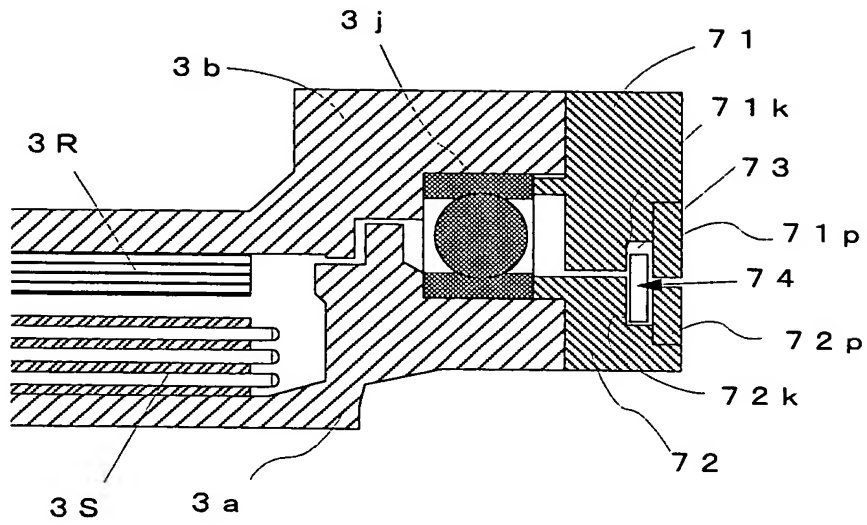


FIG. 71 (a)

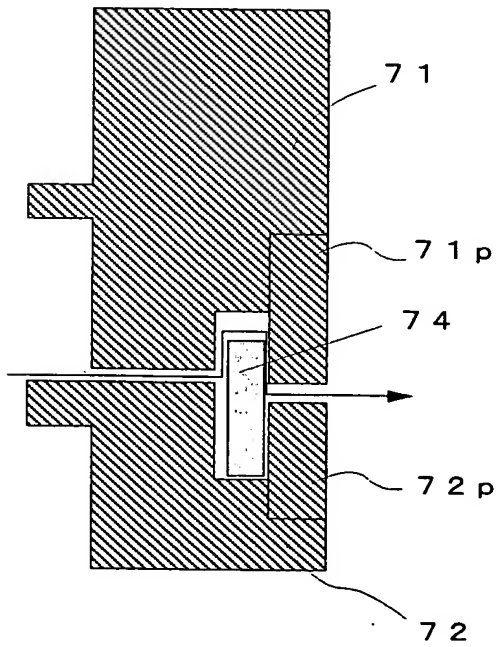


FIG. 71 (b)

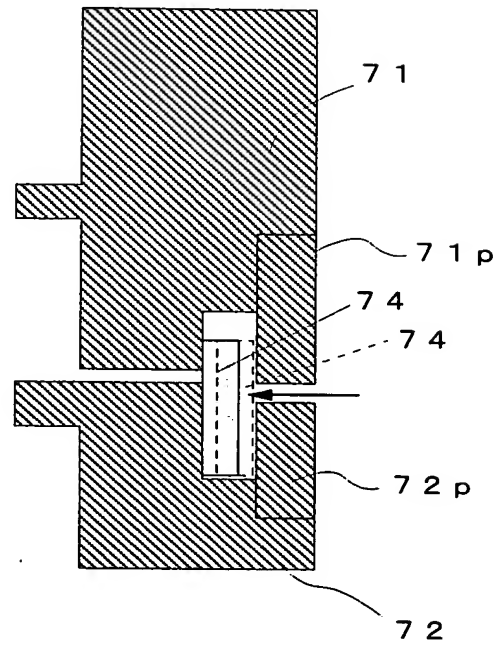


FIG.72 PRIOR ART

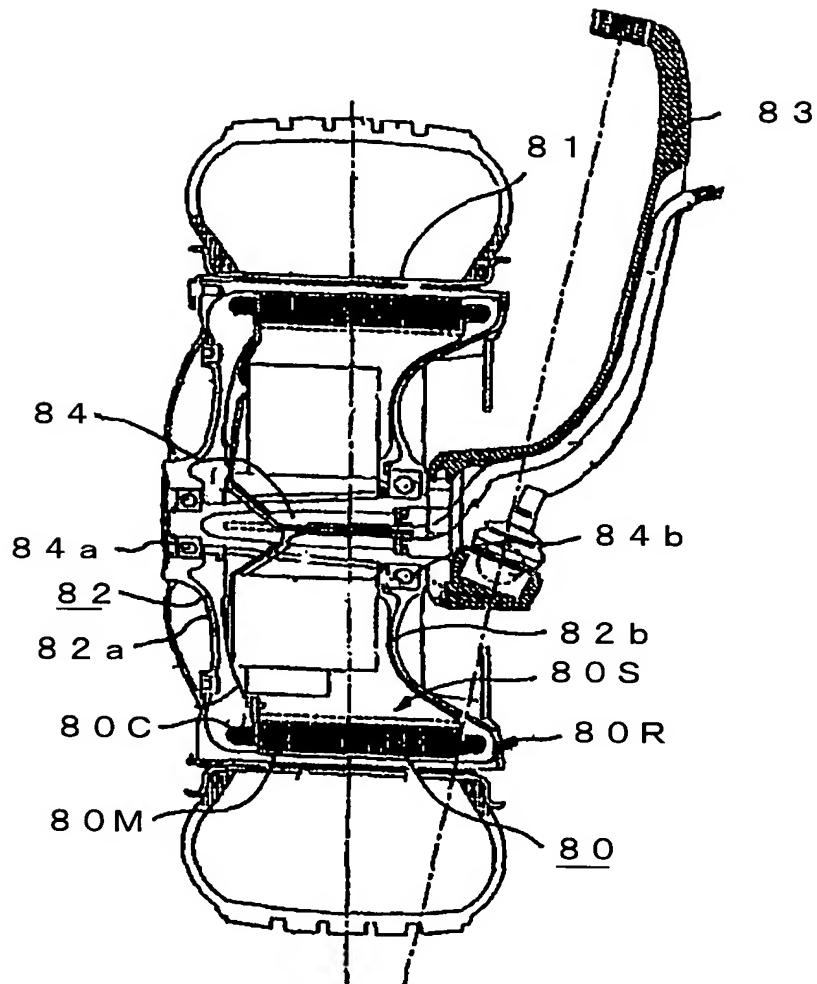




FIG. 73 PRIOR ART

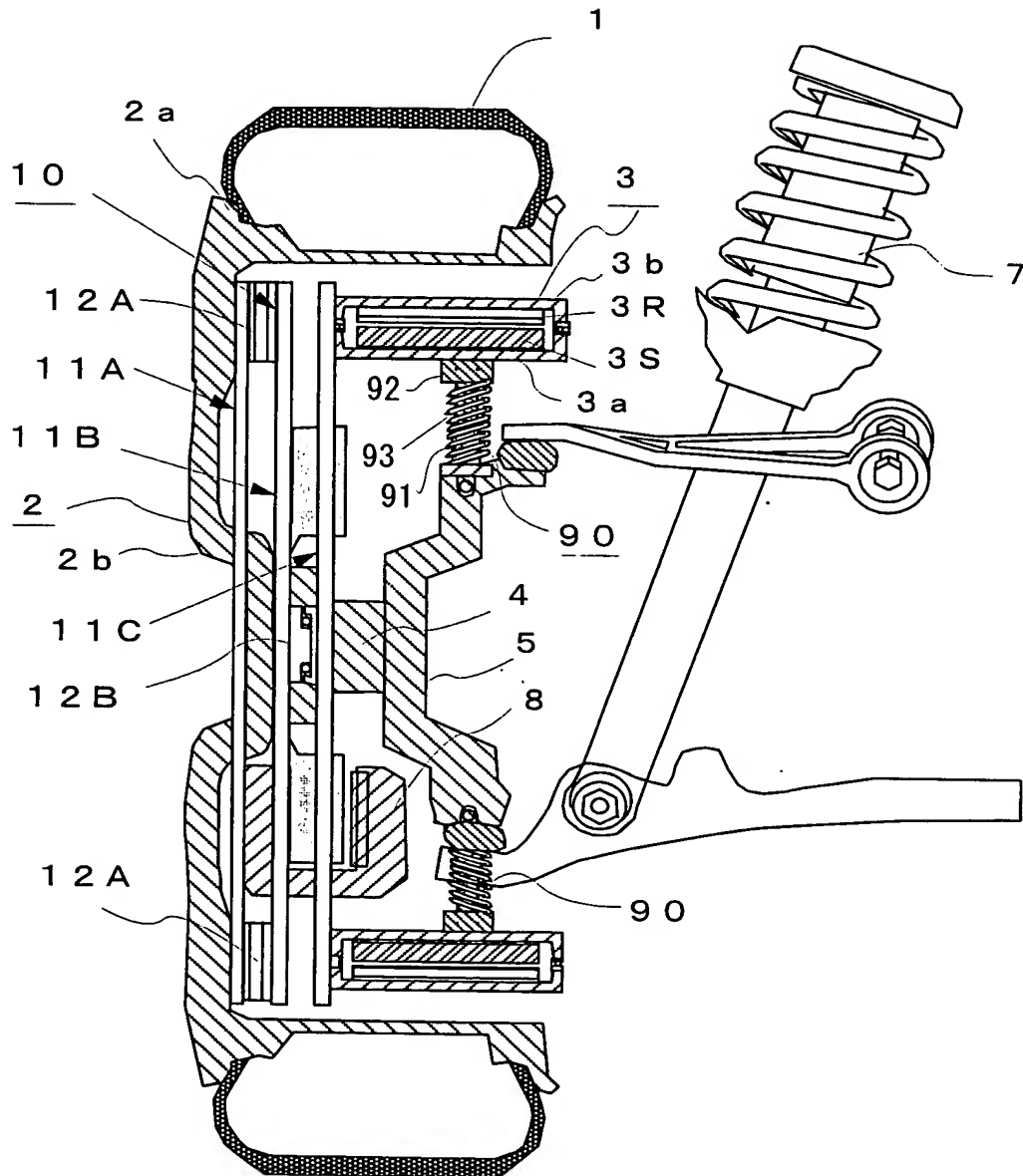


FIG. 74 PRIOR ART

